TOWNSHEND LAKE

TOWNSHEND, VERMONT

OPERATION AND MAINTENANCE MANUAL

ENGINEERING DIVISION
RETURN TO FILE

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

JUNE 1972

OPERATION AND MAINTENANCE MANUAL

FOR

TOWNSHEND LAKE

WEST RIVER

TOWNSHEND, VERMONT

June 1972

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 Trapelo Road
Waltham, Massachusetts 02154

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a. Authority. Project Operation Manual Regulation ER 1130-2-304 and Appendix I dated 25 March 1966.

b. Purpose. This manual is to provide guidance and instruction to the personnel for the proper operation and maintenance of the project facilities.

c. Parts of Manual

Part I - General
Part II - Operation and Maintenance

d. Scope of Manual. Scope of the manual is limited to the essential operation and maintenance instructions to the operating personnel for the proper upkeep, repair, maintenance and operation of the project facilities.

Chapter 2 - Project Description

a. Authorization and Location. Construction of Townshend Lake and Reservoir Project was authorized by an Act of Congress, (Public Law 761, 75th Congress, 3rd Session) as modified by the Flood Control Act of 1941 (Public Law 228, 77th Congress, 2nd Session). Further modification of the plan is contained in the Flood Control Act of 1944 (Public Law No. 532, 78th Congress, 2nd Session). An agreement was reached in 1950 between the Secretary of the Army, the Chief of Engineers and the Vermont State Water Board which modified the plan for the West River Watershed to consist of 3 reservoirs in lieu of the plan for 8 reservoirs as authorized by the Flood Control Act of 1944. Authorization for the Townshend Project is contained in the Flood Control Act of 1954. Authorization for development and use of reservoir areas for public recreational and other purposes is contained in Section 4 of the Flood Control Act, approved 22 December 1944 (Public Law 534, 78th Congress, 2nd Session) as amended. The Townshend Flood Control Lake is located on the West River in the Township of Townshend, Windham County, Vermont. It is in the southeastern part of the State about 19.5 miles upstream of the confluence of the Connecticut and West Rivers at Brattleboro, Vermont and 22 miles north of the Massachusetts border and 9.5 miles downstream of the Ball Mountain Flood Lake.

b. Description of the Project. Townshend Dam is a rolled earth and rock fill flood control structure with an impervious blanket upstream and

a rock blanket downstream of the structure. Its outlet works consists of an control weir, a combined wet well type intake tower and gate structure, bulkhead gate facilities, and a reinforced horseshoe type conduit with an inside diameter of 20 feet -6 inches founded on rock in the left abutment of the dam. Flows through the conduit are controlled by three 7.5 foot by 17-foot vertical lift regulating gates. An ungated L-shaped side-channel spillway whose weir length at elevation 533 is 438.9 feet long is located on the left abutment of the dam. Prior to construction of the Dam and Reservoir, State Route 30 was relocated from a lower elevation on the left side of the valley to the left abutment of the dam. The relocated road required extensive cuts through rock in the area of the Access Bridge which crosses the Townshend Spillway discharge channel. Access to the dam is provided by this Access Bridge from relocated Route 30. A U-shaped weir at the entrance of the center gate in the intake structure creates the permanent pool for recreation purposes.

PERTINENT DATA

RIVER BASIN:	Connecticut
PROJECT NAME:	Townshend Lake
RIVER:	West River
LOCATION:	Townshend, Vermont
DRAINAGE AREA SQ. MILES:	Total 278 (incl. Ball Mtn. d.a.) Net 106
RESERVOIR	
Permanent Recreation Pool	
Elev. ft. - m.s.l.	478
Capacity - Acre Feet	800
- Inches of Runoff	0.1
Area in Acres	100
FLOOD CONTROL STORAGE	
Capacity - Acre Feet	32,800
- Inches of Runoff	5.8
Area at Crest - Acres	735
DAM	
Type	Rolled earth, rock fill
Length - feet	1,700
Top elev. ft - m.s.l.	583
Height above river bed	133
DIKES	None
SPILLWAY	L-shaped Side Channel
Type	Ogee Weir
Length - feet	438.9
Elev. - m.s.l.	553
Distance below to top of Dam - feet	30
CONTROL WORKS	
Type	Horseshoe Conduit
Size - feet	20.5 Diameter
Length - feet	360
Invert elev. - m.s.l.	457
Capacity - full pool - c.f.s	22,900
Gates - Type	Vertical Lift
Number	3, 7'-6" x 17'-0" ea.
Size	1 Bulkhead (10'-6" x 22'-6")

TOTAL QUANTITIES	
Embankment Volume - c.y.	1,207,000
Concrete - c.y.	26,800
TOTAL COST	$7,392,400
OPERATIONAL DATE	March, 1961
PROJECT AREA - Fee (Acres)	1,010
Easement (Acres)	208
RECREATIONAL FACILITIES	Drinking water supply, 2 prkg. areas, 1 beach area; 60 picnic tables, 28 fireplaces, change house, 3 san. fac., and 1 boat ramp.
Managed by:	Corps of Engineers
NO. OF PERMANENT EMPLOYEES:	2
RADIO CALL SIGN:	WUA 45
RIVER STAGE CHECKPOINTS AT:	Newfane, Vermont
NO. OF GOV'T QUARTERS	1

c. History.

(1) Townshend Lake is one of a system of 16 dams and reservoirs that have been constructed in the Connectitcut River Basin for flood control purposes. This dam is a single unit of the comprehensive plan. The total drainage area controlled by the Townshend Lake is 278 square miles. There is one other flood control reservoir in the watershed, namely Ball Mountain Lake which is located on the West River about 9.5 miles upstream from Townshend Lake. Ball Mountain Lake controls a drainage area of 172 square miles; therefor the net drainage area for Townshend Lake is 106 square miles. The third authorized reservoir, the Island was never authorized for construction and is now in an inactive status. The project was initiated in November 1958, and the dam and reservoirs and appurtenant structures, including road and utility lines relocations was completed in June 1961. The estimated cost of the work including public use is $7,440,000.

(2) In 1970, a remedial reopen project was issued to make necessary maintenance repairs and improvements.

(3) The public use development was initiated in 1961 and continues to the present. The public use development of the project has added a valuable recreational resource in the heart of the scenic West River valley. A 100-acre conservation lake behind the dam provides an attractive setting for public bathing, boating and other aquatic sports. The recreational facilities developed for these activities have received heavy usage by vacationers and local residents. The easterly overlook provides a panoramic view of the project. A 2-lane access road descends from the top of the dam along the shore of the lake to the beach, boat launching, and picnic facilities in the westerly day-use area. Additional day-use facilities, completed in 1970, round out the day-use park development at the project. These include foot trails, additional comfort stations, change shelters, picnic facilities and landscaping. The lake supports a day-use park development that is used in conjunction with the neighboring Townshend State Forest, which has no water-based recreational development.

d. List of Project Contracts. (1) Road relocation, constructed by Perini Corp. Contract 57-285 awarded 25 April 1957 $1,273,726.73

(2) Construction of Dam and Reservoir, by Savin Brothers, Inc. Contract 59-103, awarded 30 October 1957, $3,976,756.90

(3) Rehabilitation of Operator's Quarters by Morrill Construction Co., East Acton, Mass. Contract 61-53 awarded 6 October 1960, $ 7,490.00

(4) Construction of Wire Fences by Webster & Webster, Inc. East Hartford, Conn. Contract 61-13, awarded 30 June 1961. $ 3,081.29

(5) Construction, Public Use Development by Seaward Construction Co. Inc. Contract DACW-19-016-62-14, awarded 11 August 1961.$ 63,000.00

(6) Public Use Development, Gravel Packed Well, by Able Drillers & Pump Co., Woodstock, Conn., Contract DACW-33-67-C-0065, awarded 1 May 1967.

(7) Construction Public Use Development by Tucker Const. Co., Ludlow, Vermont, Contract No. DA-19-016-CIVENG-66-69, Awarded Feb 1966.

(8) Painting Access Bridge by the Hudson Maintenance Corp. Contract DACW-33-68-C-0117, awarded 1 October 1968. $ 3,774.00

(9) Public Use Development-1968 by Stimmell Contracting Co., Contract DACW-33-69-C-0018, awarded 1 November 1968. $ 39,958.00

(10) Remedial Repairs to North Springfield & Townshend Dams by Perini Corp, Contract DACW-33-70-C-0131, awarded 31 March 1970. $452,265.00

(11) Roads & Parking Areas, by Ed-Mac, Inc. Contract 71-C-0036, awarded 12 October 1970. $ 35,725.00

(12) Rail Fencing by Wayside Fence, Contracts DACW-33-73-M-0330 and DACW-33-72-M-0270. $ 1,664.00

(13) Boom Cable from Reynolds & Sons, (21 Sept 72). (Purchase Order). $ 1,406.00

(14) Remedial Work for Access Bridge. (Purchase Order) -

(15) Roof Repair to Gate House (Purchase Order) by Jancewicz & Sons, Bellow Falls, Vt. $ 1,435.00

PART II - OPERATION AND MAINTENANCE

CHAPTER 1 - GENERAL

a. Scope. Part II of the manual covers the operating and maintenance instructions, limits, and criteria for only the major or critical project equipment and facilities and only information actually needed for the guidance of the Project Manager and others concerned with the operation and maintenance of Townshend Lake, West River, Vermont, by trained operating personnel. Information that is obvious for association with project equipment or available from maintenance manuals is not included. Chapter 1 is the introduction of Part II of the manual and includes miscellaneous items and supplementary information and requirements not included elsewhere.

b. Maintenance. (1) Inasmuch as mechanical and electrical equipment deteriorates more rapidly from idleness than continued use, all such equipment and facilities require periodic operation at frequent intervals. Periodic operation of equipment permits an inspection of the functioning of all parts so that defective ones may be replaced or repaired before their use is required for project operations. The performance of complete periodic maintenance routines as outlined in later chapters of this manual and in the appropriate maintenance manual for each piece of equipment will insure that the equipment is in proper running order at all times.

(2) Maintenance standards for the dam and reservoir not specifically covered in this manual will be consistent with objectives set forth in ER 1130-2-400 and the criteria established for recreation facilities in EM 1130-2-312. Facilities will be maintained at a standard that provides adequate protection for the health and safety of the public and shall meet and may exceed the health and sanitation laws of the State, county or city in which the project is located.

c. Safety. The Project Manager and his assistants shall be familiar with Corps of Engineers Safety Manual "General Safety Requirements" (EM 385-1-1 dated 1 March 1967) and shall comply with all applicable provisions.

d. Regulation Procedures. The Reservoir Control Center, Engineering Division, is responsible for regulation of flood control reservoirs. These procedures are included in the Regulation Manual for the West River Watershed. The operation and maintenance of all hydrologic instruments is included under the regulation manual.

e. Supervisory Responsibilities. The Project Manager will, in general, be supervising from one to several employees. He must make sure that all employees know just what is expected of them and must see that all employees carry out their duties in a workmanlike manner.

The Project Manager will plan all the work for his employees ahead of time and procure all necessary materials and equipment so that when employees get through one job they can be instantly assigned to another job. Work schedules should be set up so that work items can be completed as work conditions allow.

A good supervisor will so plan his work that one job works in well with another.

The work should be scheduled during the year so that the work to be accomplished inside of buildings may be performed in the winter months.

In the summer, the Project Manager will have a list of projects planned, both for outdoor work and indoor work. The rules and instructions set forth in this manual are for assuring that the Project Manager will have the equipment and dam in such condition that it will always be ready for emergency operation.

f. Leave. The Basin Manager shall be advised in advance whenever the Project Manager will be absent overnight from the dam or from his home. Extended annual leave will be requested from his Basin Manager. In event of emergency leave, telephone or radio contact shall be made with the Basin Manager. In all instances, the assistant project manager will be advised the detailed information as to his location and method of contact.

g. Public Relations. Project Managers should always bear in mind that they are representing the Corps of Engineers, U.S. Army, and that people within a radius of many miles think of them in that capacity. They must be diplomatic and careful in their statements, or they will find that observations lightly or facetiously made, are given disproportionate weight and publicity, very much to their embarrassment and that of the Division.

Project Managers are to be pleasant and courteous in their dealings with the public. They are expected to know, generally, the reasons for the main features of the dam, what purpose they serve and why they were so constructed. Project Managers are not expected to maintain "open house" all the time at the dam to show visitors around. However, if representative groups wish to arrange to inspect the structures, the Project Manager should accompany them. If public officials or visitors having more than a curious interest visit the dam, the Project Manager will conduct them over the project and explain as much as possible the functions of the dam. He should take pride in his job, for it is a responsible one, and in his organization; the result will be public confidence in him, the structure and the organization.

Owners of adjacent property and riparian residents who may be affected by reservoir operations should be treated in a friendly and tactful manner. Proper questions should be civilly and reasonably answered. We have nothing to hide. Explanations should be made in manner and detail as to preclude misunderstanding and subsequent criticism. Forecasting of river stages or crests or extent of damages shall be avoided. River stage forecasting is the responsibility of the U.S. Weather Service; therefore, particular care must be exercised that comments are not construed to be river stage predictions.

i. Summary of Service Duties.

(1) Daily

(a) Water surface reading from water level recorder.

(b) Precipitation reading from rain gage.

(c) Read and record thermometer values.

(d) Record weather observations on U.S.W.S. Form E-14 and Form 612-14.

(e) Clean rest and toilet rooms.

(f) During period of flood flow check operation of all remote recorders and telemarks.

(2) Weekly

(a) Operate standby unit up to operating temperature to provide power for tests. (Bi Weekly)

(b) Test crane. (Bi Weekly)

(c) Change rain gage and weekly pool elevation charts.

(d) During periods of normal flows, check remote recorders and telemarks.

(e) Clean intake structure.

(3) Monthly

(a) Inspect reservoir area.

(b) Lower service gates to closed position.

(c) Inspect battery and air filter on standby unit.

(d) Inspect power and telephone lines.

(e) Change monthly pool elevation chart and rain gage tape.

(f) Operate each engine-generator unit for two hours.

(4) Every Six Months

(a) Inspect operating house.

(b) Check all concrete structures.

(c) Change crankcase oil in standby units.

(5) Annually

(a) Check seal of gate.

(b) Oil bearings and worm gear in floor stand limit switch.

(c) Check condition of anti-freeze each fall in gasoline & diesel engines and install new or additional as required.

(d) Inspect and test life preserver vests.

(e) Inventory of property.

(f) Check all hoists including gate hoists and crane.

j. Reports.

(1) Daily Log. A daily log or record book will be maintained by the Project Manager. Entries should be made daily and should include notes of all activities outside of normal routine. The entries should be complete and should provide a record of all consequential events concerning the dam and reservoir area, daily 8 a.m. pool and outflow readings.

(2) Weekly gate operation and pool elevation report NED Form 90.

(3) Monthly report of maintenance.

(4) Monthly receiving report for electrical and telephone service.

(5) Safety report NED 618.

(6) Monthly report of piezometers and V-notch weir.

(7) Snow course reports as required.

(8) Flood control observations after each operation for flood control.

(9) Weekly hydrology report NED Form 477.

(10) Daily river and rainfall report E-14.

(11) Project monthly visitation data NED 545.

(12) Weekly motor vehicle trip ticket NED 614.

(13) Record of Purchases Monthly NED 236.

(14) Quarterly fuel consumption report.

With the exception of "Daily Log" the above-listed reports and records are submitted on prepared forms which are self-explanatory.

k. Recommended List of Spare Parts and Firefighting Equipment.

Spare Parts. The Project Manager shall have as a minimum a store of the following spare parts. An expeditious local source of supply of spare parts will suffice in lieu of storage of spare parts at the project.

(1) Electric Generator Unit.

(a) Engine, Diesel

1. Fuel pump
2. Two fuel injector nozzles
3. Fan belt
4. Two exhaust valves
5. Four valve springs
6. Two intake valves
7. Head gasket
8. Complete set of manifold gaskets
9. Fuel filter
10. Oil filter

(b) Generator

1. Set of brushes for exciter
2. Set of brushes for generator field
3. Two springs for exciter brushes
4. Two springs for generator field brushes

(2) Gate Hoists.

1. Two coils for motor starters
2. Six sets of contacts for motor starters

(3) Electrical

1. Twelve fuses for every size used on job
2. 100 ft. of No. 12-600 volt wire, 2-conductor
3. Two rolls rubber tape
4. Two rolls friction tape
5. Spare floodlight bulbs
6. Fuse puller

(4) Firefighting Equipment. The dam has a portable fire pump and will keep the following standard equipment complement, stored in an easily accessible place, along with the pumper:

1. 10 batteries, flashlight
2. 1 small tool box
3. 1 oil can, squirt
4. 1 five-gallon can, Protectoseal, Underwirters Laboratories approved, filled with four gallons of regular gasoline
5. 1 pump backpack carrier
6. 2 starting cords
7. 2 flashlights
8. 1 2-in oil funnel
9. 1 screened funnel
10. 50 hose gaskets, 1-1/2"
11. 1 one-pound can of cup grease
12. 1 peen hammer
13. 2 flexible gasoline hoses
14. 2,000 feet of 1-1/2" linen hose
15. 50 feet of 1-1/2" suction hose
16. 2 eight-foot lengths of 1-1/2" suction hose
17. 1 first aid kit, filler only
18. 1 pint oil measure
19. 2 nozzles, 1-1/2" (1 adjustable fog & 1 combination)
20. 6 quarts of oil (outboard motor oil - SAE 30)
21. 1 oil can opener
22. 1 galvanized pail
23. 1 pair of adjustable pliers
24. 2 pounds of rags
25. 1 screwdriver
26. 2 sets of sparkplugs (extra)
27. 1 suction strainer, 1-1/2" (disc type)
28. 1 5-gallon gasoline tank (empty)
29. 2 rolls friction tape
30. 1 check and bleeder automatic valve
31. 1 pressure relief valve (this may be in combination with the automatic check valve)
32. 2 bleeder valves

33. 1 Siamese valve
34. 2 Wescott type wrenches
35. 1 set of ignition wrenches
36. 1 pump wrench
37. 1 sparkplug wrench
38. 2 spanner wrenches

(5) All other spare parts recommended by manufacturers manuals.

1. Listing of Drawings. The following drawings cover the major items covered under this manual. Copies are on file at the dam. Those indiciated by asterisk are inserted at the end of Part II of the manual.

(1) Road Relocations, Contract No. DA-19-016-CIVENG-57-285

Drawing No.	Sheet No.	Title
CT-1-4215	1	Project Location & Index
CT-1-4216	2	Key Plan
CT-1-4217	3	Key Profiles
CT-1-4218	4	Typical Section Sheet
CT-1-4219	5	Item Details & Drainage
CT-1-4220	6	Item Details & Drainage
CT-1-4221	7	Guide Rail with Steel Posts
CT-1-4222	8	Miscellaneous Details
CT-1-4223	9	Construction Details
CT-1-4224	10	Barricades, Signs & Lights
		Routes 8 & 30 Relocations
CT-1-4225	11	Plan, Grading & Drainage Sta. 0+42.50 to 7+42.60 Sta. 10+00 to 20+00
CT-1-4226	12	Profiles, Sta.0+40.5 to 7+42.60 Sta. 10+00 to 20+00
		Route 30 Relocations Grading & Drainage
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CT-1-4228	14	Sta. 35+00 to Sta. 50+00
CT-1-4229	15	Sta. 50+00 to Sta. 62+00
CT-1-4230	16	Sta. 62+00 to Sta. 74+00
CT-1-4231	17	Sta. 74+00 to Sta. 86+00
CT-1-4232	18	Sta. 107+50 to Sta. 119+00
CT-1-4233	19	Sta. 119+00 to Sta. 133+00
CT-1-4234	20	Sta. 133+00 to Sta. 148+00
CT-1-4235	21	Sta. 148+00 to Sta. 162+00
CT-1-4236	22	Sta. 162+00 to Sta. 176+00
CT-1-4237	23	Sta. 176+00 to Sta. 190+00
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CT-1-4239	25	Sta. 204+00 to Sta. 219+00
CT-1-4240	26	Sta. 219+00 to Sta. 234+00
CT-1-4241	27	Profile Sta. 219+00 to Sta. 234+00
CT-1-4242	28	Sta. 234+00 to Sta. 247+00
CT-1-4243	29	Plan, Details & Sections Culvert Ext. Sta. 81+91.50
CT-1-4244	30	Plans, Elevation & Section Ranny Brook Culvert Sta. 121+43
CT-1-4245	31	Sections & Elevations Ranny Brook Culvert

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CT-1-4250	36	Sta. 17+00 to Sta. 18+50
CT-1-4251	37	Sta. 19+00 to Sta. 20+50
CT-1-4252	38	Sta. 21+00 to Sta. 22+50
CT-1-4253	39	Sta. 22+50 to Sta. 23+00
CT-1-4254	40	Sta. 23+50 to Sta. 24+00
CT-1-4255	41	Sta. 24+50 to Sta. 26+00
CT-1-4256	42	Sta. 26+00 to Sta. 26+50
CT-1-4257	43	Sta. 28+00 to Sta. 29+00
CT-1-4258	44	Sta. 29+50 to Sta. 31+00
CT-1-4259	45	Sta. 31+50 to Sta. 32+50
CT-1-4260	46	Sta. 33+00 to Sta. 34+50
CT-1-4261	47	Sta. 35+00 to Sta. 36+50
CT-1-4262	48	Sta. 37+00 to Sta. 38+50
CT-1-4263	49	Sta. 39+00 to Sta. 40+00
CT-1-4264	50	Sta. 40+50 to Sta. 42+00
CT-1-4265	51	Sta. 42+50 to Sta. 45+50
		Route 30 Relocation Cross Sections
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CT-1-4272	58	Sta. 63+00 to Sta. 67+00
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CT-1-4277	63	Sta. 78+00 to Sta. 81+00
CT-1-4278	64	Sta. 81+50 to Sta. 84+00
CT-1-4279	65	Sta. 84+50 to Sta. 86+00
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CT-1-4282	68	Sta. 107+50 to Sta. 111+50
CT-1-4283	69	Sta. 112+00 to Sta. 113+00
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CT-1-4305	91	Sta. 152+50 to Sta. 153+50
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CT-1-4310	96	Sta. 159+50 to Sta. 160+50
CT-1-4311	97	Sta. 161+00 to Sta. 161+50
CT-1-4312	98	Sta. 162+00 to Sta. 162+50
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CT-1-4326	112	Sta. 180+00 to Sta. 181+50
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CT-1-4335	121	Sta. 200+00 to Sta. 202+00
CT-1-4336	122	Sta. 202+50 to Sta. 204+00
CT-1-4337	123	Sta. 204+50 to Sta. 206+00
CT-1-4338	124	Sta. 206+50 to Sta. 208+00
CT-1-4339	125	Sta. 208+50 to Sta. 210+00
CT-1-4340	126	Sta. 210+50 to Sta. 212+00
CT-1-4341	127	Sta. 212+50 to Sta. 214+50
CT-1-4342	128	Sta. 215+00 to Sta. 215+50
CT-1-4343	129	Sta. 216+00 to Sta. 216+50
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m. Equipment and Drawing Files. This manual does not include operating and maintenance instructions and other maintenance information which are covered or included in the equipment and drawing files of the Project Manager. These files include operating manuals, design memorandum, shop drawings of equipment, catalog cut and maintenance instructions, and other supplementary information. The items on file are as follows:

(1) Operation and Maintenance Manuals

Ford tractor & loader
Inter 1 ton dump
Chemical feeder
Worthington compressor
Ford Flail mower
Ford York rake
Simplicity tractor
Chain saw (2)
Sabre saw
Pacific pump
Water pump (rec)
Sprayer Bean
Stearns power mower
Standby unit Diesel
Kohler generator (2)
Gravely tractor
Toro lawn mower
Lawn boy mower
Chev. 1/2 ton pickup

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b. Regulating Gate Hoist No. 30756 7 B Manning, Maxwell, Moore, Inc.

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c. Information Covering Slack Rope Limit Switch and Traveling Nut Limit Switch for Townshend Dam Regulating Gate Hoist, West River, Vermont.

d. Reduction Equipment for Regulating Gate Hoists, Townshend Dam, West River, Vermont 19-016-59-7 Design Analysis and Gear Capacity Data.

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Proposal for 25 Ton Capacity Crane Manning, Maxwell, Moore, Inc.		
f. Jib Crane, Wall Mounted, Control Tower. No. 48-20662 Manning, Maxwell, Moore, Inc. Drawing Numbers:	210812 701753 701935 407234 502981 308003	
g. Platform and Support	62-500 through 64-500	1 through 3
h. Fermont Electric Generator with P&H Diesel Engine Control Tower Townshend Dam		
Diesel Electic Standby Unit, International Fermont Mach. Co.	D-5710	
P&H Diesel Engine, Harnischfeger Corp.	Z4-2	
Electric Plant 60 DNT S-4 International Fermont Mach. Co.	AD-60	
Outline Dimensions (Electric Plant) Federal Electric Products Co. Bulletin 902	AD-1025	
1 50 Gallon Tank (Electric Plant) Mass. Engineering Co. Inc.	60-7998	
Type SN-2 Spring Isolator (Electric Plant) The Vibration Eliminator Co.	MY-56291	
Outline Dimensions (Overload Relays, Electric Plant) Federal Elec. Produce Co. Bulletin 504	AD-1516	
Operation and Maintenance Manual Fermont Machinery Co. Inc.		

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Cast Iron Junction Boxes & Cable Entrance Seals, Float Well O.Z. Electrical Mfg. Co.	3270-8-3	
Heavy Duty Junction Box Type YH, Float Well O.Z. Electrical Mfg. Co.	683-JB	
Inside Flanged Recessed Cover Box Type "YU", Float Well O.Z. Electrical Mfg. Co.	684-JB 686-JB 685-JB	
Type TM 3 Tubular, Float Well, Edwin L. Wiegand Co.	BC-21504 BAX	
Floatwell Flooding System, Savin Brothers Inc.	1	

j. Submersible Pumps, Utility Bldg. Deming Division, Bulletin # 6700-5-1

Pump Test, The Deming Co. 34 13 through 34 12

k. Mark Deep Well Stroke Pumps, Comfort Station Claton Mark & Co, Catalog # P 2

l. Plumbing Supplies, Utility Bldg., American Standard Specifications for supplies used.

m. Hydro Pneumatic Tanks, Water Heater, Utility Bldg., John Wood Co., Specifications for materials used.

n. Drinking Fountain, Utility Bldg., American Standard, VD 13, Specifications for materials used.

o. Plumbing Supplies for Comfort Sta., American Standard, Specifications for materials used.

p. Chem O Feeder Modle 1330, Feed pump, Proportioneers Division of B.C.F. Industries, Inc., Ref. # 1330.20 1 Specifications for materials used.

Heating Systems

Wall Fin Convectors, Trane Co.
Bulletin # DS 392

Booster Pump, Townshend Dam Oper. Quarters, Utility Bldg.
Bell & Gossett Co.
Spec. Form # 186 B

Booster Pump, Townshend Dam Oper. Quarters, Utility Bldg.
Webster Electric Div.
Bulletin # BA B

Pump Fuel Oil Transfer
Viking Co.
Specifications on materials used.

Registers, Townshend Dam Utility Bldg.
United States Register Co.
Specifications on Materials used.

Furnace, Control Tower Townshend Dam
Mammoth Furnace Co.
Specifications on materials used.

Control Values, Heating
Detroit Control Co.
Specifications on materials used.

Copper Fittings, Heating
Grabler Mfg. Co.
Catalog # G 12

Unit Heaters, Utility Bldg., Townshend Dam
The Trane Co.
Bulletin # D 327

Furnace Townshend Dam, Oper. Quarters, Utitity Bldg.
American Standard
Specifications on materials used.

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Piezometer and V-Notch Weir readings recorded from 12/10/64 through the present. On file.		

a. Slopes and Gutters. (1) Slopes (Cover Rock, Gravel, Grass). The slopes of the dam, including those protected by rock or gravel, must be carefully watched for settlement or erosion. Slopes shall be kept free of debris; rock and gravel slopes shall be kept free of vegetation.

(2) Burrowing animals constitute a hazard to any embankment. Although there is little probability of rodent holes beneath a rock fill which is bedded on gravel, the Project Manager should watch for rodents around the slopes and destroy them by poison and traps. Gravel slopes shall be maintained in a smooth even plane.

(3) Protection Stone. Protection stone of all types shall be kept free from debris and vegetation; dislodged stones must be promptly replaced.

(4) Grassed Slopes. Periodic inspections shall be made of all grassed slopes and other grassed areas to note subsidences,slides, erosions, etc. Corrective action in the form of drains, pervious blankets, etc., will be directed by the Operations Division when the failures or incipient failures are of substantial magnitude. All grassed areas shall be mowed at least once a year. On many areas it will be necessary to mow two or more times a year to keep up the appearance and discourage the growth of weeds. When necessary to reestablish turf, the seeding operations will start at the earliest practicable date in the spring or fall to obtain the greatest possible protection against erosion. Areas requiring seeding shall be dressed to proper grade, and irregularities in the surface removed. The surface should then be raked or harrowed parallel to the contour of the slope (never up and down) to a depth of three-quarters of an inch. Debris shall always be removed promptly; deposits of debris are unsightly, detrimental to the growth of grass and encourage the nesting of rats and other burrowing animals.

(5) Gutters. These shall be kept in effective condition with displaced rock promptly replaced. Principal hazard is from erosion at edges, caused by flows beyond the capacity of the gutter or by blockage. Failure is progressive and rapid.

(6) Observations shall be made for potentials for major rock falls or slides in spillway and outlet works where blockage may result. Report such potential falls promptly to Operations Division and Basin Manager.

(7) Embankments and Fills. Visual observation by employees working on or near embankment fills for erosion, slides, settlement, springs, boils and other unusual conditions. Close inspection yearly of embankments and fills to detect leaks, settlement, excessive erosion, and slides. The embankment and fills should be maintained to original grade and alignment. Repair depressions or washouts that might tend to weaken the embankment or fill.

b. Inspection During Floods. (1) The behavior of the dam during floods is of vital importance and interest. Periods of storage are the times of danger and if weaknesses develop, it is essential that they be noted and prompt corrective action taken. The Project Manager must recognize that a condition which is of minor importance with a relatively low head may assume serious proportions with increasing pool levels, and he must be constantly alert to note and report even minor failures or changes in the conditions of the embankment. Results of a single careful inspection of the embankment during a flood can be more significant and valuable than a great number of equally careful inspections when the embankment is not impounding water.

(2) When the reservoir is filling or is storing water, the assistant Project Manager will inspect the exposed faces of the dam with particular attention to the downstream face, the dam abutments and the area adjacent to downstream face of dam for "springs", sand boils, subsidences, sloughing of embankment or abutments, or other indication of leakage through, around or under the dam. Any evidence of increased flow from new "springs" or the movement of soil particles shall be immediately reported.

(3) When the reservoir is being drawn down, the Project Manager will inspect the exposed faces of the dam, with particular attention to the upstream face and abutments for slides or indications of incipient slides. The Project Manager will also observe if there is any slides or sloughing of banks in reservoir area. On the dam proper, the guard rails on top of the dam, if well aligned, will provide a means to detect lateral movement of the dam top that may precede a slide. Any evidence of slides or incipient slides shall be reported immediately.

(4) During the first filling of the reservoir, and each time the reservoir is filled to a higher level than previously experienced, inspection of the downstream faces of dam shall be particularly detailed and conducted at least twice daily during storage and at least three times weekly during drawdown until two weeks after completion of drawdown. During subsequent filling, storage and drawdown periods, inspections of the embankment may be conducted less frequently, but when above El. 517, inspections shall be made once a day during filling and storage and during drawdown.

c. Piezometer Tubes. Check annually for deterioration of paint and pipes. Touch-up and repaint as necessary. Replace pipe sections as necessary.

CHAPTER 3 - INTAKE AND OUTLET WORKS, RETAINING WALLS, BUILDINGS, BRIDGES AND SPILLWAY

a. Concrete and Masonry and Exterior Surfaces - General. (1) Visual inspection by employees working on or near the dam to detect cracks, leaks, collection of ice or heaving of slabs; movement and misalignment of walls, debris formation, displacements, offsets at joints, or other irregularities. A close and more complete inspection to detect cracks, leaks, spalling, and deterioration of concrete or masonry will be made semi-annually. Normally, concrete and masonry structures require only limited maintenance; however, when failures occur, report conditions to Basin Manager so that timely repairs can be made by others in order to prevent serious damage requiring replacement of costly repairs.

(2) Expansion Joints. Visually inspect annually for signs of leaks, defective joint material or faulty water stops. Clean joints and fill with filler as required. Report required repairs as necessary.

(3) Concrete. The concrete structures shall be carefully inspected at intervals of six months and after each major filling operation. In addition, conduit shall have its interior inspected every time the pool is drained for any reason. The inspection shall include a survey of the general conditions of the concrete surfaces, noting location and extent of cracks, crazing and spalling, and other type of deterioration or disintegration that may have developed, the accumulation of debris, and other unusual conditions. Surfaces adjacent to cracks shall be inspected for differential movement; similar inspections shall be made of construction and expansion joints. Any point or points of leakage will be noted and the condition of all water passages inspected for evidence of erosion or cavitation. The exposed portion of embedded items and the concrete adjacent thereto shall be carefully inspected. All drain holes shall be cleaned. Any condition requiring or suspected to require corrective action shall be brought to the attention of the Operations Division immediately. The inspection shall be made a matter of record with report submitted to Operations Division, including a sketch showing the location and nature of the defects. All accummulated debris shall be removed at spillway, outlet structure, channels, etc.

(4) Exterior Surfaces. Visually inspect all surfaces annually (except as otherwise stated) to discover cracks, damaged finishes, broken block or brick, faulty joints, missing, warped, or defective siding; check around all openings for cracks and leaks; check metal siding for loose nails, defective siding; check around all openings for cracks and leaks; defective gaskets or fastenings. It should be noted that exterior

surfaces of intake structure will be made semi-annually. Project Manager shall repair and replace damaged surfaces to the extent of his ability; report conditions not considered repairable by Project Manager to the Basin Manager.

b. Retaining Walls. (1) In cases where the slopes are confined by a retaining wall, the wall shall be normally inspected every two years except inspection shall be made daily when the pool level is equal to half the height of the dam. Any movement, cracks or seepages through or around the wall must be noted and promptly reported.

(2) Retaining wall will be inspected once every two years to accertain irregularities such as stress cracks, settlement, tilting, erosion along top of wall, clogged weep holes, deterioration of wall material, displacement, and undercutting of foundation. Provide good drainage to prevent erosion and scouring at the base and top. Keep weep holes open.

c. Omitted.

d. Stop Log Structures. Water level must be equal on both sides of stop log structure to perform any maintenance such as removal or replacement.

e. Log Booms. The log booms will be inspected monthly for broken logs or evidence of rot near holes that contain the ends of the boom chains, and for damaged cables or chains. When operating during large inflows into the reservoir or when ice is in the river, the log boom will be under stress and must be at full strength at all times. Logs not floating will be placed on concrete blocks to keep them off the ground. Spare boom logs shall be available and shall be stored off the ground. All debris collecting behind log booms shall be removed during inspection and especially after large inflows into the reservoir.

f. Tile and Staff Gages. Clean the tile and staff gages regularly to facilitate reading. When cleaning the gages, check for cracking, spalling, or abrasion, and insure that gages are securely in place.

g. Buildings. (1) Roofing and Flashing. Close inspection shall be performed semi-annually to detect leaks, loose or missing shingles, blisters, weathered built-up roofing, displacement of gravel, damaged ridge or valley coverings; particularly check plastic flashings at vents, and vertical intersections of roof; check metal flashings and counter flashings for loose seams rusting or galvanic action. Following heavy rains or severe storms check roofing and flashings for leaks, missing or damaged shingles or other damage.

The secret of trouble-free low-cost maintenance is a regular resaturation of the membranes or plies of felt while it is still sound. Gravel or slag surfaced roofs need only spot resaturation where the membrane has become exposed, replacing gravel over the resaturated area. Open up large blisters and repair to protect underlying plies. Keep roof drains open and roof well drained. Indication of water under membrane should be thoroughly investigated to locate the source and repair immediately. Investigate all cracks or other defects and if more than a single ply is affected, repairs should be made promptly.

(2) Floors. Examine annually floors (concrete) for cracks, settlement, scaling, dusting, pitting and deterioration; (wood) buckling, splintering, loose boards, sagging, loose or missing covering materials; asphalt, quarry, ceramic and vinyl tile floors for condition.

(3) Railings and Metal Work. (a) All metal work on equipment, gratings, railings, ladders, etc., shall be kept neatly painted. Windows shall be kept well flashed. Front entrance doors shall be examined, particularly on the top, for holes. The metal doors shall be completely sealed to prevent the entrance of moisture which would corrode the door from the inside. All holes shall be promptly sealed. Changes in color shall not be made without prior approval.

(b) Examine supports, treads, railings, grating, anchors and bolts for rust, deterioration and rigidity every two years.

(c) In order to assure that maintenance is adequate and timely, performance of the following is essential:

Tighten all loose bolts and anchorage items.

Repair all broken welds and defective members.

Replace worn or slippery treads.

Keep all stairways, landings and catwalks cleaned of debris, free of obstructions, grease, and oil and keep hand railing rigid and well secured to base.

Replace broken catch basin and manhole covers promptly.

(4) Windows, Doors and Screens. Once each year, check weather stripping, calking around framing, stops, door closers, locks, latches, screens, glazing, hinges and stiles. Following heavy rains or severe storms make an inspection to determine extent of damage to windows and doors. Replace broken glass promptly.

(5) Wood framing and sheathing. Every two years, check for dry rot, loose or missing boards or shingles, warped, checking, settlement, leaks, or other irregularities. Make close inspection of floor joists, sills and beams for termite damage.

Maintain sufficient ventilation under floor areas to dispel moisture and undesirable odors. Replace or reinforce defective material and treat for termites as necessary.

(6) Gutters and Downspouts. Inspect condition, every two years, of fixed and slip joints, check gutter hangers, and spacers for adequacy, tightness, alignment, rust, deterioration, clogged strainers or downspouts, leaves or debris.

(7) Interior Walls and Ceilings. Close inspection every two years to detect cracks in plaster, water stains, deteriorated plaster, broken or damaged tile, mildew, broken or damaged wall board or paneling, disfiguration or other damage.

(8) Insect Control. Insects shall be disposed of by periodic spraying and/or treatment.

(9) Stairways, Wood. Check condition, every two years, of treads, handrails, and anchorage for wear, deterioration and safety conditions.

g. Bridges. Bridges will be inspected periodically by engineering personnel to determine condition of the paint or to note evidences of damage or incipient failure. Periodically, bridges will be completely repainted by contract.

a. Water Supply and Sewer Systems. (1) Observe component of each system weekly for good condition and proper operation in connection with water wells, distribution lines, treatment facilities, etc.

Every year the above systems shall be closely inspected for good condition and proper operations. Drain and clean systems thoroughly, as applicable to insure satisfactory operation. All pneumatic and gravity storage tanks come under the above requirement.

(2) Potable Water Tests. All water treated by the project manager shall be tested semi-annually for chlorine content. Send sample of water for analysis as required by State or local authority. Where there are no local or State requirements, water shall be analyzed at least semi-annually.

(3) Piping. When in the area of piping, observe for indications of leaks. Where possible examine systems for leaks, excessive corrosion or other damage annually. Inspect pipe covering or coating where provided. Repair or replace piping, covering or coating as needed to maintain good condition. Clean piping system as necessary. Check piping system identifying markers, clean and replace as required.

(4) Valves. When in the area of valves, observe for indications of leaking valve stem, flanges or connections. Inspect valves for leaks and general condition annually. Renew packing if needed. Reseat or replace valve and tighten connections as required. Be sure valve is left in normal operating position.

(5) Plumbing systems. Check annually plumbing fixtures and exposed pipe and pipe covering for leaks, malfunctioning and damage. Check relief valves of hot water tanks.

(6) Sewer systems. Inspect annually grease traps, fixture traps, discharge lines, septic tanks and leaching fields for proper functioning and leaks.

(7) Water wells. Check top of casings semi-annually for damage which will permit surface water to enter; drain before freezing weather.

(8) Water from wells or other sources provided for human consumption shall meet State and local requirements. Water tests will be made as required by the State health agency and in a manner approved by that agency. Contaminated wells will be closed to public use. Well will be capped and maintained in a manner to preclude contamination from surface run-off.

b. Heating and Ventilating. (1) General. Observe for proper operation.

(2) Duct Systems. Check duct system for general over-all condition once a year. Tighten loose connections and supports as needed. On systems using oil-type air filters be sure that oil vapor is not being carried over into duct system. Clean system as required to maintain good condition.

(3) Louvers and Dampers. Observe louvers and dampers for proper functioning and good condition. Adjust, repair and clean annually or as necessary for good operation.

(4) Air filters. Observe air filters bi-monthly for good condition and proper operation. Replace dirty filters.

(5) Heating and Ventilating Fans. Observe belt drives semi-annually for condition and satisfactory operation. Repair and clean fans as necessary to maintain good operating condition.

(6) Plenum chambers. Observe condition of plenum chambers. Inspect doors for good seals and latches. Repair, adjust and clean as needed.

(7) Heating and Ventilating Controls. Examine all thermostats, step controllers, contactors etc., annually to determine items are in good condition and operating satisfactorily. Adjust or repair as needed to provide proper operation.

(8) Heating System (Forced Warm Air). Prior to the heating season, preferably during summer months, the heating unit shall have a complete check up and cleaning by a qualified oil burner service company. This shall include a complete cleaning of the furnace and oil burner. The oil burner shall be adjusted for proper combustion, electrode setting checked, firing rate and nozzle angle noted, draft regulation adjusted for proper draft over the fire and at the breeching, condition of the combustion chamber noted, stack, fan and limit switches checked, fuel oil filter cleaned or replaced. A complete combustion and efficiency test shall be preformed and all data recorded for record. Combustion Test Data Sheet shall be used. Check and oil forced-air-fan and motor. Check fan blades as needed. Check fan belt tension, tighten same and/or replace same if necessary. Clean or replace air filters as necessary. Check thermostat for satisfactory operation and general condition. Inspect chimney flue, clean out debris as necessary.

(9) Boilers, Steam and Hot Water. At the end of the heating season drain and flush boiler and refill. Prior to the heating season, preferably during the summer months, the heating unit shall have a check up and cleaning by a qualified oil burner service company. The oil burner shall be adjusted for proper combustion, electrode setting checked, firing rate and nozzle angle noted, draft regulation adjusted for proper draft over the fire and at the breeching, condition of the combustion

chamber noted, stack, pressure and high limit operating controls checked, fuel oil filter cleaned or replaced. A complete combustion and efficency test shall be performed and all data recorded for record. Combustion Test Data Sheet shall be used. Check condensate pump and control in steam heating system. Check hot water circulator pump and circulator control in forced hot water heating systems. Check hot water circulator pump oil sump and oil as required. Check thermostat for satisfactory operation and general condition. Inspect chimney flues, clean out debris as necessary.

c. Telephone and Radio Equipment. (1) Exterior telephone equipment. Observe condition of poles, insulators, pins, hardware, cable messengers, telephone cables and wires, terminal boxes, protectors, etc. Report unsatisfactory condition to Utility Company.

(2) Radio Equipment. During normal project use, observe that equipment is functioning properly. Check condition of antenna and report any required repairs as necessary. Observe conditions of lead-in conductors; report any damage as necessary. See that components of both emergency generator and normal power supply are in good condition. Check condition of remote units, recorders, tone relays, telemarks, etc., for good condition.

a. Roads, Parking Areas, Trails and Walks. (1) Continuous visual inspection for irregularities such as slides, settlement, rutting, potholes, washouts, pumping; damage to signs, guard rails, abutments, retaining walls, culverts and other hazardous conditions. Hazardous conditions shall be corrected immediately. During or following heavy rains or storms. Inspect for flooding, washouts, settlement, slides, fallen trees and other obstructions.

(2) Pavements. Visually inspect all pavements annually to determine the need for repairs to expansion joints, cracked or broken sections, settlement due to failure of subbase or subgrade material, drainage or subgrade, scaling, spalling, abrasions, raveling at edges of flexible pavements, potholes, rutting, shoving, bleeding, weathering surface drainage, wash boarding, and excessive amounts of dust. Perform all seasonal maintenance operations, to extent of available equipment and personnel, such as cold patch repairs, crack and joint filling, etc., at the proper time and according to the best practices in the area for maximum benefits. Roads will be resurfaced and/or sealed with the type of surface originally constructed; Operations Division to be notified through Basin Manager of pavements requiring reconstruction, repair or sealing.

(3) Shoulders and Roadside. Inspect annually all shoulders and roadside for drop-offs from pavements, rutting at pavement edge, proper slope for drainage, proper width, stability, slides, gullying, and obstruction to vision. Shoulders must be maintained with a smooth surface flush with adjoining pavement and to correct slope, width, and section. Keep shoulders and roadside clear of tall weeds and brush. Preserve and plant grass where it assists in preventing soil erosion. Sod, plant shrubs or vines when grass seed will not grow on eroding slopes.

(4) Walks, Roads and Parking Areas. All gravel and dirt access roads and parking areas in the dam and recreation areas will be maintained in good condition and repair throughout the season. Calcium chloride or other dust retarding agents will be used when prolonged dry weather creates a safety hazard. Bumpers of concrete, stone or wood will be provided in and around the outer edges of parking areas for uniform alignment of and to exclude vehicles from blocking emergency exits or trespassing on grassed areas. Rules and regulations are to be conspicuously posted off parking areas.

(5) Paths and Trails. Throughout the recreation area and reservoir continuing inspection shall determine the brush and trees which have to be removed. This is especially true after flood water impoundment. Low hanging limbs and side brush must be removed. At projects where trails are used during winter months, trail signs and small stream crossings should be inspected regularly.

b. Traffic Services and Signs. (1) Traffic Services. Inspect traffic services annually for legibility, damage, obstruction from view, signs and markers conforming to highway standards as to size and shape; automatic devices operating properly; guard rails, snow fences, and traffic control devices in good repair; road hazards properly marked by signs, lights, or devices and at proper distances from hazard; detours properly marked; traffic lanes plainly and properly marked.

(2) Signs. All rustic directional, warning and project identification signs in recreation areas shall be taken down at the close of the season, stained, lettering repainted, and insignia replaced if required. These signs will be stored under cover. The formula for the stain shall be 1 part burnt umber coloring, 2 parts turpentine and 10 parts boiled linseed oil. Standard highway type metal signs shall be removed and stored also. Replacements and additional signs or posts will be ordered before commencement of the recreation season through the Basin Manager. All wood sign posts in place are to be given a coat of stain, if weathered, before attaching signs. Permanent signs shall be repainted as required.

c. Drainage. Inspect semi-annually for adequacy of drainage systems; stoppage or catch basins, culverts, gutters, ditches, under drains; undermining of headwalls, foundations, road shoulders, abutments; ponding, gullying, and clogged drainage pipe. Existing drainage structures such as catch basins, manholes, ditches, gutters, drainage pipe, and flumes must be cleaned periodically in order that they may be kept free of debris and perform their designed function. As a minimum program, a complete inspection is made in the fall in preparation for the winter season and another in the spring, to determine extent of repairs required. Priority for accomplishing drainage maintenance shall be in accordance with established priorities.

d. Guard Rails and Fences. (1) Concrete posts, metal posts and rails, and partially and untreated wood posts and rails in guard rails and fences will be painted all white. All fence rails will be painted white; treated wood posts will not be painted. Decayed wood posts and broken concrete posts shall be replaced and wire cable kept at proper tension. Steel or concrete guard rail posts shall be replaced when unserviceable and painted when required. Wood and metal guard rail and posts shall also be checked frequently and painted when weathering is observed.

(2) Fences. Inspect annually to determine the need for repairs to gates, locks, and fencing. Fences and accessories shall be maintained to provide the maximum security for which they were designed. Repair all breaks as soon as they are discovered, replace unserviceable gate locks, promptly. To maintain harmony with adjacent areas subject to public scrutiny, painting may be desirable.

(3) Chain link fencing will generally not require painting. If required due to excessive rusting, etc., the Basin Manager should be notified.

e. Grounds. (1) General. Visual inspection for loss or damage to vegetation, need for mowing, insect control, ponding, flooding, erosion, clogged or overgrown streams or drainage systems, damaged fences, gates, trees, shrubs and vines.

(2) Improved Grounds. Close inspection annually by experienced personnel for soil deficiencies, damaged trees, shrubs, erosion, and vegetation; need for topsoiling, reseeding, sodding; weed, dust, and insect control; pruning, trimming, planting, and mulching. During or following storms, heavy rainfall, or drought make an inspection for flooding, downed trees, damaged trees, shrubs, vegetation and need for repairs. Improved grounds generally consist of lawns in vicinity of operators quarters and other buildings, all landscaped areas, and recreational areas and should be maintained in keeping with the use and intensity of such use.

a. Grassed areas, under normal conditions, should be mowed during the active growing season to a height of 1-1/2 to 2 inches. Mowing should be not more frequent than necessary to prevent the grass exceeding a height of 3 to 5 inches. Reseeding, weed control, fertilizing, and irrigating should be performed only when the appearance of the grass indicates a need for such treatment.

b. Shrubbery should be trimmed in accordance with the requirements of the species and as needed to present a suitable appearance.

c. Shade and ornamental trees. To avoid frequent repruning, anticipate tree growth for two to three years and prune accordingly. Remove dead or broken branches or those that extend over buildings and shape to present a suitable appearance.

(3) Semi-improved Grounds. Inspect annually to determine the need for mowing, reseeding, sodding, trimming, pruning, removal of brush and flammable vegetation for under and around wood structures, erosion and dust control; clearing of streams and drainage ditches, and application of fertilizers. Semi-improved grounds consist of roadsides, shoulders, open areas adjacent to lawns and similar areas and which require less attention than do improved grounds. These areas should be mowed with tractor-operated equipment to a height of 2 inches or more when the grass reaches a height of 5 to 7 inches or when excessive uneven growth of grass or weeds becomes unsightly. Reseeding and fertilizing is limited to kind and rate necessary to sustain vegetative cover for the control of erosion by wind and water. Drainage ditches, gutters, and channels should be cleaned of wooded plants, vegetation and other matter that restricts flow, at least once a year.

(4) Unimproved Grounds. Inspect annually to determine the need for erosion and dust control; clearing fire lanes, power and communication lines right-of-way; mowing of flammable vegetation. Unimproved grounds

are areas that do not fall within categories above and require only minimum maintenance. Clear firebreaks and clean under and around wood structures yearly. Anticipate tree growth for two to three years and remove branches overhanging buildings, roads, power and communication lines accordingly.

f. Bathing Areas. Sand shall be plentiful and kept free of ruts and holes. Dragging or harrowing will keep the beach area adjacent to the water on an even plane. Constant daily inspection is required to determine if debris, broken glass or other sharp objects are left after periods of heavy usage. Surface water drainage shall not be directed over loose sand beaches. Floats to warn bathers of deep holes or limits of safe swimming are to be installed and properly maintained.

g. Change House and Comfort Stations. All roofs, exteriors, and interiors are to be inspected regularly for deterioration and signs of vandalism. Major repairs and painting shall be scheduled during periods when usage is at a minimum. All doors shall be checked to ascertain that they operate properly and that latches are in good working condition. Comfort Stations and Change Houses will be kept scrupulously clean and all necessary accessories provided the visiting public. Fixtures in pit latrines shall be cleaned daily and odor supressants added when required. All holding vaults or tanks should have solids removed and be properly flushed by a contractor specializing in septic tank services. It is mandatory that pit latrines, holding tanks, or vaults be cleaned or pumped out at the end of each recreation season.

h. Boat Ramps. Boat ramps shall be checked and maintained in comformity with above instructions listed under Paragraph a, Roads, Parking Areas, Trails and Walks. Areas adjacent to the ramp will be kept free of brush and debris. Containers for trash will be made available and emptied regularly. Rules and regulations governing the use of the area will be posted by the Project Manager.

i. Picnic Facilities. Picnic tables require periodic cleaning by washing with a detergent. Tables shall be treated to combat grease and similar type stains. Unserviceable table tops or seats shall be replaced. Wood tables not anchored will be placed on end during the winter months. Brush and debris shall be removed on a regular basis. Poisonous plants shall be sprayed with approved weed or brush killer. Grilles, barbecues, and fireplaces shall be maintained in safe condition and shall be repaired when deterioration is evident. Units beyond repair are to be replaced. In dry season precautions will be taken to cope with fire hazard. Hazardous trees will be trimmed or removed. Aeration of soil should be accomplished in areas where ground has become compacted to a degree that is injurious to trees. Picnic areas will be maintained in a clean and sanitary condition.

j. Refuse Collection. (1) Visual inspection weekly during the active season to determine the police of area, frequency of collection, and condition of containers. Inspect area following severe storms or flooding to determine extent of damage, loss of containers, or existence of any health or safety hazards.

(2) Trash containers will require emptying and cleaning as frequently as the visitation load dictates. Paint containers inside and out as required and the letters PLEASE stenciled on, using white paint. During the off season, the barrels are to be inverted when stored outdoors.

k. Insect and Rodent Control. Visual inspection to detect breeding places where treatment will be most effective, such as ponds, swamps, and thick tall vegetation. The nature and degree of insect and rodent control will be sufficient to meet requirements of State and/or local health agencies. The extent and intensity of larviciding will be frequent enough to maintain a level of Anopheles quadrimaculatus below the level determined acceptable by the State health agency. Drift should be piled and removed during draw-downs for more effective mosquito control areas. Intense public use may require spraying to control insects in picnic areas. The application of chemicals will be confined to refuse collection points and around toilets but not on picnic tables where food could be contaminated. Poison to control rodents will be used in a manner that will not permit harm to public.

l. Snow Removal. During winter months all access roads designated by the Project Manager shall be kept plowed and sanded. Provide stakes where necessary (in full) to outline limits of roadways and parking areas to avoid damage to areas and structures beyond limits of pavement.

m. Removal of Dead and Down Timber. The reservoir area, particularly in the lower levels, will be kept cleared of all down and dead timber. This may be disposed of by chipping the slash and the timber which is of no value; it may be cut into four-foot lengths and used by the Project Manager or, if any merchantable or salable quantities are available, it will be sold by the Supply Division of the Division Office. Chips may be spread as a mulch on slopes above spillway level.

n. Cutting of Wood by Others. All standing timber in the reservoir area, as well as other natural resources, is Government property. Therefore, the Project Manager is not authorized to permit any person or persons to cut and/or remove any standing timber from the reservoir area or to countenance such removal. Persons desiring to cut wood should be advised to write to the Division Engineer, furnishing details of his proposal, including the information on the size, species, quantity, location, etc., together with an offer.

a. Gates. (1) Regulating and Bulkhead Gates and Guides

(a) Weekly. When and as conditons allow, each gate shall be tested for satisfactory operation.

(b) Quarterly. Thoroughly lubricate gates and hoists. Carefully examine hoisting cables for wear and damaged cable. Lubricate as required.

(c) Annually. Check each gate when full closed for leakage and proper sealing. During operation of the gate hoists, check bearings, wear on gear teeth, and brake shoes. Check limit switch contacts for cleanliness, pitting and corrosion. Check the closing limit switches setting; stretching of the hoist cables may necessitate adjustment of the switches. These switches shall be so adjusted that the weight of the gate is off the cables when the gate is in the closed position; however, serious damage to the cables will result if the cable is allowed to become loose enough to fall off the sheaves of the lower block. Check seals, roller race guides, and roller chains on all gates, clean and replace damaged seals and other items if necessary. The roller chains are hardened stainless steel and paint or lubricant should never be applied to them. All rusted metal on the gates shall be thoroughly wire-brushed and spot painted.

(d) Observe if there is any vibration during raising or lowering of gates in water.

(2) Motor Operated Hoists. Annually. Gate Hoist operator motors shall be oiled once each year, or more often if required by the manufacturer's recommendations. The end bearings and the worm in the limit switches shall be oiled with a few drops of S.A.E. 20-W oil.

b. 25-Ton Crane with Hoist and Regulating Gate Hoists. (1) Safety and Warning Devices. (a) Annually. Inspect to see that all safety and warning devices are in service and in a safe and proper operating condition. Project Manager shall prepare a list of all items required to be inspected--this information is available from operating manuals. Repair or replace worn, broken or unsafe operating equipment as necessary.

(b) Semi-annually. Crane and hoists used at infrequent and varying intervals shall have a good visual inspection of all safety and warning devices thereon and all devices found unsafe or defective put into a safe and proper operating conditon before using the equipment.

(2) Operational Tests. (a) Weekly. All crane and hoist equipment will be operated a sufficient length of time to determine that the equipment is in a safe and satisfactory working condition and ready for service. These functions include the bridge traverse, the trolley traverse, the raising and lowering of the hooks and all its speeds.

(b) Annually. Dynamometer test for hoists as directed by Operations Division.

(3) Crane and Hoist Brakes. Semi-Annually. Inspect brake lining and renew if needed. Check brake drums for scoring. Repair or replace as necessary. Adjust brake and spring tension. Renew springs if stretch indicates fatigue. See that thruster is in good condition. Adjust and repair to assure safe operation.

(4) Shafts, Couplings and Bearings. (a) Annually. Visually inspect shafts, couplings and bearings for indication of excessive wear. Lubricate according to manufacturer's recommendations.

(b) Two Years. Examine shafts and couplings for indication of misalignment. Adjust, repair and lubricate as needed. Flexible couplings shall be repacked with grease according to manufacturer's recommendations. Adjust or replace bearings if clearances are excessive.

(5) Gears and Gear Boxes. Two Years. For open gears, observe, and for enclosed gears, listen for indications of broken or excessively worn teeth, misalignment or improper meshing. Check gear box shaft packing and joints for leakage. Make necessary repairs and adjustments to assure proper operation. Lubricate according to manufacturer's recommendations.

(6) Lifting Beam and Spreader Beams. Before using, check for alignment, corrosion and tightness of rivets and bolts. Check condition of slings and pins. Lubricate as needed. Observe carefully for any indications of over-stressed members. Repaint as required.

(7) Blocks and Hooks. (a) Inspect blocks and hooks before lifts. Check safety latch on hook.

(b) Semi-Annually. Inspect for indications of bending or stretching of the hook.

(8) Rails, Supports and Stops. 2 Years. Inspect for misalignment and obstructions. Check concrete supports for cracks and spalling, steel supports for corrosion and loose rivets and bolts. Repair, tighten, caulk, etc., as needed to assure safe and proper operation. Check stops for proper condition and security. Repair or adjust as needed.

(9) Bridge and Carriage. 2 Years. Inspect framework for looseness and cracks. Check rivets and bolts for tightness. Observe girders for corrosion and indications of misalignment. Take necessary remedial action to maintain in satisfactory and safe operating condition.

(10) Trucks and Wheels. 4 Years. Inspect trucks for slew and condition of metal. Examine wheels for excessive wear and flats. Rebuild or machine wheels as needed. Repair and clean as necessary.

(11) Bumpers. 4 Years. Examine for looseness. See that bumpers and/or stops are properly positioned. Tighten or adjust as necessary.

(12) Hoist Cables. Annually. A good visual inspection shall be made of the cables for kinks, frayed cable and corrosion. Lubricate the crane and/or hoist cables. Clean cables by wire brushing, scraping or blow down with compressed air. Apply lubriciant with a stiff brush, passing the cable through a lubricant saturated waste or drip on at a point where the cable opens slightly from bending.

(13) Crane Electrical System. 4 Years. Check for broken insulators, condition of brick wires or rails, shoes, and wheels. Clean and check slack in the bridge conductors and collectors. Check brush rigging.

(14) Power Supply Cables. (a) Annually. Visual inspection for condition of cable, plugs and receptacles.

(b) 2 Years. Examine control system and cable, plugs, and receptacles closely. Check condition of retractable cable needs and connections to collector rings. Repair as necessary.

(15) Hoists. Annually. Inspect hoisting machinery for gates and crane hoists to determine general condition. Check for worn or defective links, pins, hooks, cables, and see that components are properly lubricated. Repair or replace excessively worn or defective parts and apply lubricant or preservative to maintain equipment in satisfactory and safe operating condition.

c. Bulkhead Gate Monorail Hoist (4 Ton) and Jib Crane Hoist (1 Ton).

(1) Semi-Annually. Each hoist shall have a good visual inspection of all parts thereon and all parts found unsafe or defective put into a safe and proper operating condition before using the equipment.

(2) Operational Tests. (a) Monthly. All hoist equipment including geared trolley will be operated a sufficient length of time to determine that the equipment is in a safe and satisfactory working condition and ready for service. These functions include the hoist traverse and the raising and lowering of the hooks.

(b) Annually. Dynamometer test for hoists as directed by Operations Division.

(3) Hooks. (a) Inspect hooks before lifts. Check safety latch on hooks.

(b) Semi-Annually. Inspect for indications of bending or stretching of the hooks.

(4) Safety and Warning Devices. (a) Annually. Inspect to see that all safety and warning devices are in service and in a safe and proper operating condition. Project Manager shall prepare a list of all items required to be inspected--this information is available from operating manuals. Repair or replace worn, broken or unsafe operating equipment as necessary.

(b) Semi-Annually. Hoists used at infrequent and varying intervals shall have a good visual inspection of all safety and warning devices thereon and all devices found unsafe or defective put into a safe and proper operating condition before using the equipment.

(5) Hoist Motor and Load Brakes. Semi-Annually. Inspect brakes. Repair or replace as necessary.

(6) Hoist Cables. Annually. A good visual inspection shall be made of the cables for kinks, frayed cable and corrosion. Lubricate the crane and/or hoist cables. Clean cables by wire brushing, scraping or blow down with compressed air. Apply lubricant with a stiff brush, passing the cable through a lubricant saturated waste or drip on at a point where the cable opens slightly from bending.

(7) Electric Service. Annually. Visual inspection for conditon of limit switches and push button controls. Repair as necessary.

d. Generators and Motors. (1) Generator and Motor Foundations. Bases or Supports. When making an operational tour, observe for any unusual conditions. For generators, integral horsepower motors and engines, inspect for cracks or other damage. Inspect anchor bolts for indications of looseness. Observe for signs of loosening or damage to dowel pins (if provided). Tighten or repair as necessary.

(2) Standby-Units: Operational. (a) Bi-Weekly. Each standby unit shall be operated each week to bring engine to operating temperature. Before and after each weekly run, the level of the water in the radiator and the oil in the crankcase shall be checked. After each run, the exhaust piping shall be drained of condensate. The weekly testing of equipment shall be done while the standby unit is being operated, with the standby unit furnishing all the energy. Before, during and after the weekly test operation, operation data will be recorded on Standby Electric Generator Unit Location

Form. Any malfunction of the unit shall be repaired if possible by the Project Manager, and reported to the Basin Manager if it cannot be repaired. The crankcase oil shall be changed every 100 hours of operation or every 6 months, whichever is sooner and when the oil is at operating temperature so that complete drainage will result. Replace the oil filter element every other oil change.

(b) Monthly. Once a month the standby unit operational run shall be extended to 2 hours unless otherwise required by unit manual. Carefully inspect the storage battery, air cleaner, oil filter, fuel pump and service according to instructions furnished by the engine manufacturer. Operational data will be recorded on Standby Electric Generator Location form.

(c) Monthly. Operational Test. Inspect commutator, collector rings and brushes for satisfactory operation. Observe brushes to determine if replacement is required. Inspect condition of commutator and collector rings, polish if grooved or rough. Commutators and collector rings with a good surface and polish should not be disturbed. Wipe commutator and collector rings with canvas.

(d) Antifreeze no longer requires draining at the end of each cold weather season; it may be retained in the cooling system for an extended period dependent on the outcome of a hydrometer test accomplished during performance of scheduled Preventative Maintenance Service on the engine.

(e) Annually. Clean the slip rings and commutator and blow out same with dry compressed air.

(3) Brush Rigging. Annually. Inspect the brush rigging and tighten bolts, screws and connections. Check brush spring tension and brush fit. Replace brushes as necessary.

(4) Motors, Fractional Horsepower. Fractional horsepower motors will be given periodic visual inspection as scheduled by the Project Manager. Attachment bolts or screws tightened. Motors lubricated in accordance with project lubricating schedule. Clean external surfaces, check motor couplings, pulleys and belts, tighten or replace as required.

e. Electrical Equipment. (1) Primary Equipment and Cables. No attempt at maintenance of the primary equipment, cables and transformers shall be made by operating personnel. A visual inspection shall be made and any maintenance or repairs required shall be reported to the Utility Company and the Basin Manager.

(2) All maintenance in connection with the following items will be performed by personnel from Operations Division.

(a) Switchboard Wiring and Generator. Annually. Check switchboard, secondary wiring and generator cables. Check all lugs and connections for tightness. Check ground connections for continuity. Perform insulation tests on all circuits, motors and generator windings.

(b) Knife Switches. 2 Years. Examine for evidence of heating; see that hinges and contacts are in order and that interlocks, if provided, are in good conditon. Repair or replace as needed.

(c) Motor Starters. 2 Years. Examine starters for condition. Repair and replace parts necessary to place starter in good operating condition. Check auxiliary contacts and interlocks for proper operation. Check motor control devices for satisfactory operation.

(d) Control Cables (Including single conductor control wiring). Examine monthly exposed sections of cables for signs of overheating, corrosion or other damage to insulation or sheath, supports, and terminations.

(3) Storage Batteries. Monthly. Check for leaking battery cases. Check and record specific gravity of all cells. (Note condition of hydrometer, replace if required). Clean corrosion products from intercell connectors and terminals. Add distilled water as needed. Coat connections with a film of battery terminal grease. Follow battery manufacturer's instructions for giving batteries an equalizing charge.

(4) Lighting (as required). (a) Replace burned out lamps. Replace flashing fluorescent lamps as soon as possible. Continuous flashing may damage the ballasts.

(b) Replace broken parts.

(c) Clean reflectors and lenses.

(d) Replace defective switches.

(5) Switchboard and Panels (Annually).

(a) Check all fuses. Keep spare fuses on hand. Locate and correct source of trouble before replacing fuses. Use proper rated fuse. A higher rated fuse will not protect circuit. Do not insert fuse on live circuit because it may arc and cause a poor contact and blow fuse. Make sure fuses are tight with good contact.

(b) Check breakers for operation.

(c) All connections should be tight. Check all bolts and screws and clamp and tighten if loose.

(6) Readings (Semi-annually).

(a) Check voltage. Voltage that is too high or too low will affect the life, efficiency and economy of equipment.

(b) Check motor currents observed with nameplate ratings.

(c) Check frequency.

(d) Megger all feeders and circuits (by Personnel from Operations Division)

(e) Megger all generator and motor windings (by personnel from Operations Division).

(7) Interlocks (Annually).

(a) Check interlocks for proper operation.

(b) Check padlocks and locks on electrical enclosures.

(8) Rubber Mat. Maintain a clean rubber mat in front of switchboard.

(9) Lightning Protection (Annually).

(a) Check continuity of ground wires.

(b) Check flagpole ground.

(c) Check arrester grounds.

(d) Check antenna mast ground. (if applicable)

(e) Check switchboard ground.

(f) Ground wires exposed to mechanical injury should be protected by conduit.

(10) Receptacles (Annually).

(a) Replace defective units.

(b) Check ground continuity on grounding type.

(11) Portable Cords.

(a) Arrange cords so that electrical connection bears no mechanical strain.

(b) Protect all lamps used with an extension cord with a lamp guard.

(c) Check insulation and plugs.

(12) Wiring.

(a) Check for proper support.

(b) Check insulation for deterioration caused by age, abrasion, moisture, oil, heat or other causes.

(13) Neutral. Check neutral ground on supply. This ground is usually connected to a metallic water piping system on the street side of any meter which could interrupt the continuity of the metallic circuit to ground. Check connections for tightness.

CHAPTER 7 - FIRE PREVENTION

a. General. All fire fighting equipment must be kept in instant readiness for operation at all times. At least four fire rakes will be kept in a place readily accessible.

(1) During times when there is a danger of forest fires, the Project Manager shall be on the alert for fires in the reservoir. He shall be familiar with all sources of water in the reservoir area and during the dry season shall have up-to-date information as to the availability of water. In areas distant from the river, water holes in low areas will be developed to provide a supply. Existing water holes shall be kept well cleaned out. A substantial fence shall be kept around all water holes for purposes of safety.

(2) The dam is provided with a portable fire pump with a complement of accessories and 1-1/2" hose. Observe pump and associated equipment weekly for general condition. This pump shall be assembled with its accessories once a month (except during the freezing weather) and run for a short time. Chapter 1 includes a list of the equipment to be included with the portable fire pumps. All of the equipment given in the list shall be kept in one place and ready for instant use at all times. It must be borne in mind that when this equipment is needed, the personnel sent to get it will be excited and hurried, and unless all the equipment is grouped in one place, some important item may be overlooked resulting in serious delay.

b. Extinguishers.

(1) Carbon Dioxide (CO_2) Extinguishers.

Monthly. Visual inspection for proper location and condition. Check seals.

Semi-Annually. Weigh units and recharge if weight is more than 10 percent less than normal. See paragraph c (1) for test.

(2) Dry Chemical Extinguishers.

Monthly. Visual inspection for proper location and condition of extinguisher.

Semi-Annually. Inspect chemical for condition. Weigh cartridges to determine charge. Repair and refill as required. See Paragraph c (2) for test.

c. Testing Extinguishers.

(1) Carbon Dioxide (CO_2) Extinguishers. Perform hydrostatic cylinder test in accordance with Interstate Commerce Commission (ICC) test procedure:

(a) When emptied by use, if time elapsed since last test exceeds five years, or

(b) When time elapsed since last test exceeds twelve years, or

(c) When corrosion, damage or the like warrant regardless of time elapsed.

(2) Dry Chemical Extinguishers. Return to manufacturer for inspection and test:

(a) Every five years, or

(b) When corrosion, damage or the like warrant regardless of time elapsed.

d. Fire Hose.

Monthly. Visual inspection monthly of nozzles and connections. See that the hose is hung in proper position and place for use in case of fire.

Annually. Test all hose annually except unlined linen hose at system pressure. Defective hose will be replaced with new hose.

5 Years. Test unlined linen hose every five years at 25 pounds higher than normal system pressure.

e. Nozzles and Playpipes. Visual inspection monthly for condition. See that equipment is kept in the proper place for ready use. Repair or replace as needed.

f. Fire Doors. Inspect and manually operate monthly to insure equipment is in good operating condition.

g. Flammable Waste Containers. Observe that containers are in the proper locations; that proper type containers are being used and are in good condition. Observe that lids fit securely. Be sure that flammable waste is properly disposed of.

h. Fire Warning Signs. Observe that adequate warning signs are properly located. Check signs for good condition.

i. Fire Plan and Emergency Instructions. Observe adequacy of posted fire and emergency instructions monthly. Check adequacy, condition, and current status annually. Revise as required.

CHAPTER 8 - ENVIRONMENTAL PROTECTION

a. Scope. The Project Manager shall perform his operating and maintenance work in such a manner so as to prevent, to the extent practicable, environmental pollution as the result of Government activities as well as activities by others on the Government property. For the purpose of this manual, environmental pollution is defined as the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to man; or degrade the utility of the environment for aesthetic and recreational purposes. The control of environmental pollution requires consideration of air, water, and land, and involves noise and solid waste-management, as well as other pollutants.

b. Regulations. In order to prevent, and to provide for abatement and control of, any environmental pollution arising from the activities of the Government personnel and others on the reservoir, the Project Manager shall make sure that all people using or working at the project comply with all applicable Federal, State and local laws, and regulations concerning environmental pollution control and abatement, and all applicable provisions of the Corps of Engineers Manual, EM 385-1-1, entitled "General Safety Requirements," latest issue in effect.

c. Air Pollution. Some forms of air pollution control are covered in other chapters such as dust control and maintenance of roads and herbicides and insecticides. Further, EM 385-1-1, "Safety - General Safety Requirements" requires control of air pollution wherever it is a safety and health hazard. Air pollution originating and caused by project operations shall be eliminated or decreased. The Project Manager shall comply with project air pollution standards set forth by Federal, State and local agencies.

d. Water Pollution. Care shall be exercised not to pollute the rivers and to maintain water quality standards. Major sources of water pollution are wastes from floating plant (fuel, oil, grease), herbicides and insecticides, sanitary and other waste disposal from buildings, shops and storage areas, and spillage of fuel, grease, oil, etc.

e. Land Despoilment. Of all forms of despoilment by land equipment, landscape defacement is the most permanent. When a tree is removed needlessly or damaged by burning waste too close to it, repair or replacement takes years. When a fill of the earth, gravel, sand, etc. is made in the wrong place, the environment may be marred for the life of the project. Common land despoilment actions include destruction of land forms and vegetation and pollution of the land by spillage and waste. Outside of recreation and similar areas, care shall be exercised in controlling public travel or usage.

f. Noise Pollution. This area of pollution includes a wide range of causes, from faulty mufflers on equipment to use of explosives. Noise pollution is most serious in congested areas and in enclosed operations. The Project Manager shall make every effort to reduce and control generation of noise detrimental to human environment due to Government activities including control due to a variety of noise producing operation and maintenance machinery and activities.

CHAPTER 9 - MISCELLANEOUS

a. Mobile Equipment, Tools, etc. (1) General. The maintenance and operation of a flood control dam requires a substantial amount of property, tools and equipment. It is the policy of the New England Division to provide the Project Managers with sufficient tools and equipment to properly maintain and operate the dams, related structures and reservoir with a maximum of efficiency. The Project Manager must bear in mind that the more tools and equipment they acquire the greater their capability of maintenance.

(2) Government-Owned Miscellaneous Small Gasoline Powered Plant. Test operate each engine weekly. Check general condition of unit during the test operation and repair any deficiencies noted.

Each engine will be given a thorough check biannually by a competent mechanic. Replace excessively worn parts and repair as necessary.

Check oil, water, and fuel before and after each use. After each use clean and service the unit so that it is ready for the next operation. Always fill the gas tank after each use.

On small miscellaneous plant that is seasonal in use, the engines will be drained, cleaned, and properly lubricated for storage during the non-use season. Batteries, if any, for such plant will be placed on a trickle charger, and their condition checked each month.

(3) Miscellaneous Tools. All items should be kept clean and in good working order at all times. Tools with an edge should be kept sharp. Broken handles on axes, shovels, hammers, etc., should be promptly replaced.

b. Motor Vehicle Maintenance. (1) Preventative maintenance on motor vehicles under the jurisdiction of the Project Manager. Maintain equipment as recommended by vehicle manufacturer and as outlined in subparagraph (2) below:

(2) Periodic Motor Vehicle Maintenance Guide. This guide will be used as the equipment requires and in conjunction with the Operator's Manual from the manufacturer.

(1) Weekly

1. Check
   Radiator for fluid level and leaks
   Fan belts for tension and wear
   Batteries for water level
   Engine oil
   Transmission oil if applicable
   Tires for pressure and abrasions
   Fuel - keep fuel tank full

(2) Monthly

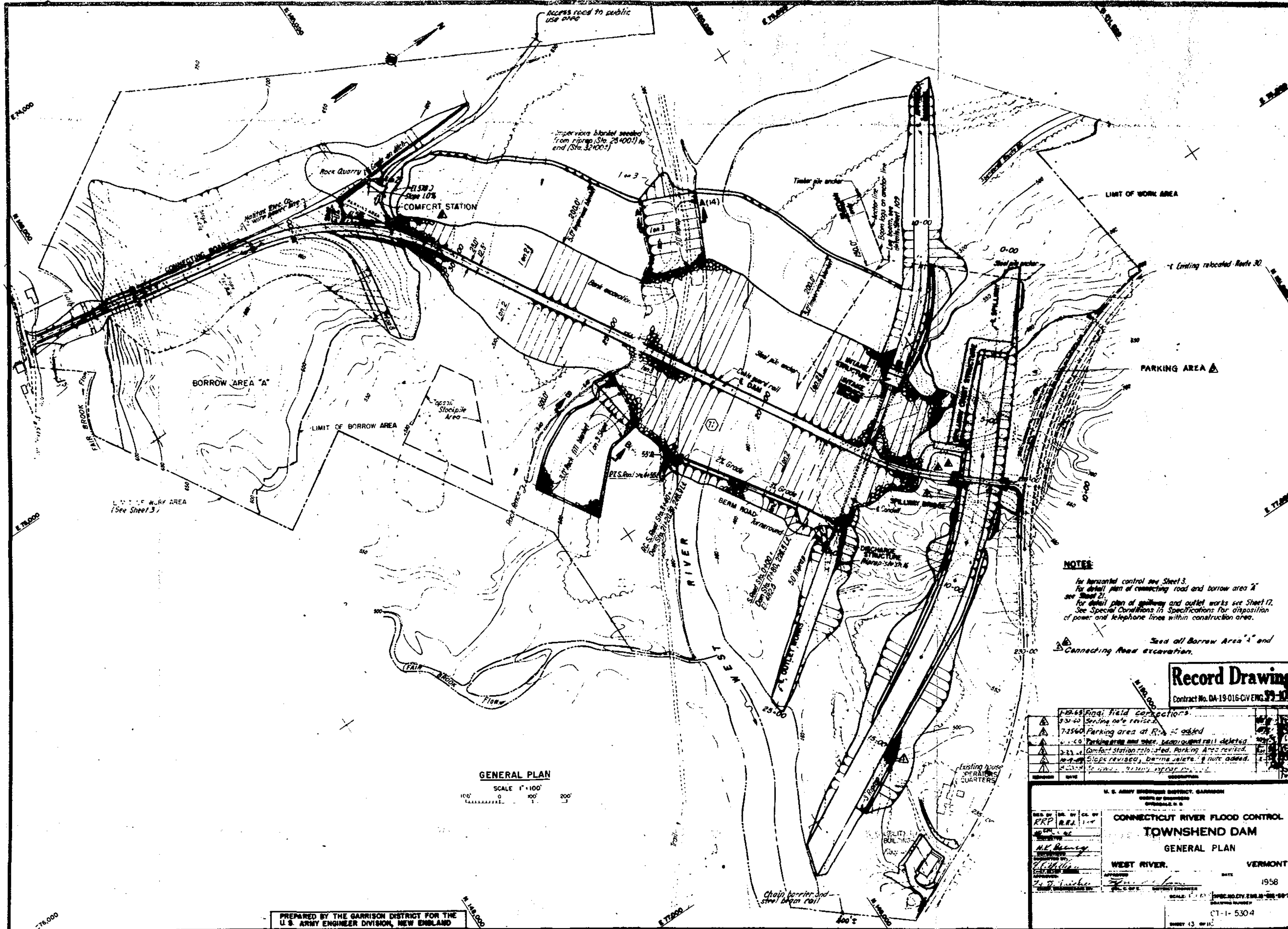
1. Check weekly items
   Power steering oil level
   Brake fluid level
   Hydraulic fluid level

2. Service
   Air cleaner

c. Maintenance Records. (1) Maintenance records shall be kept on Card Form #314 as required in Engineer Regulation ER-58-2-1, Change 1, Appendix 11, dated 31 May 1968.

d. Snow Shoes. After the winter period, snow shoes should be wiped clean, the wood and webbing varnished with high grade spar varnish, and stored. Two thin coats of varnish are preferable to one thick one. The shoes should be tied securely, back to back, and a block of wood forced into the space between the toes. They should be placed out of the sun and suspended by a wire so that mice or squirrels cannot get at them.

e. Oil Storage Tanks. Drain condensate from all oil and fuel storage tanks at least once every two years. Clean above ground tanks and repaint or recoat as required. Check liquid level devices for satisfactory operation. Check gage glasses for leaks.



NOTES:

For horizontal control see Sheet 3.
For detail plan of connecting road and borrow area "A" see Sheet 21.
For detail plan of spillway and outlet works see Sheet 17.
See Special Conditions in Specifications for disposition of power and telephone lines within construction area.

Seed all Borrow Area "A" and Connecting Road excavation.

Record Drawing
Contract No. DA-19-016-CIV ENG-59-105

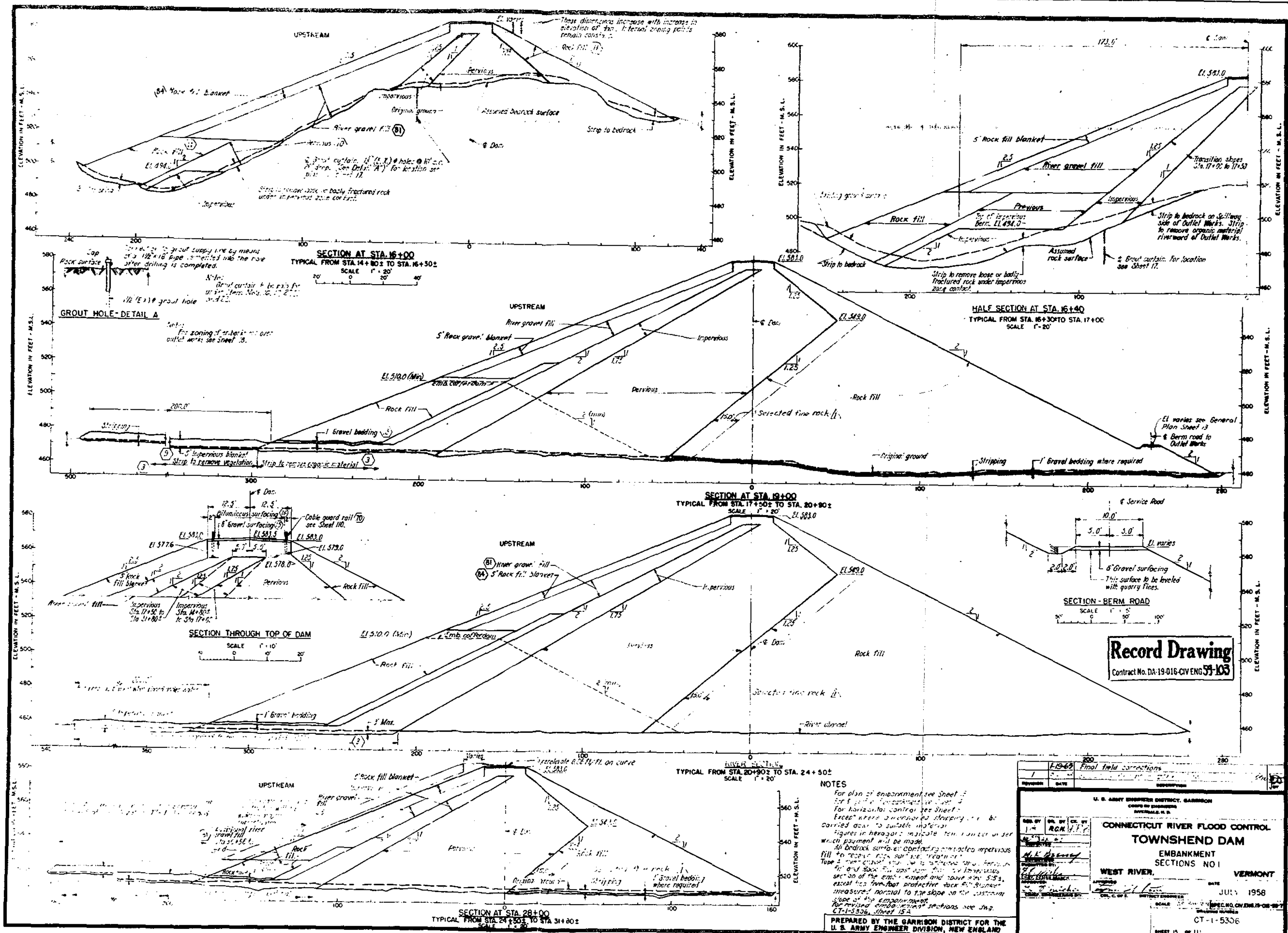
Revision	Date	Description
	1-19-65	Final field corrections.
	3-31-60	Seeding note revised.
	7-25-60	Parking area at Rte. 30 added
		Parking area and shed, cable guard rail deleted
		Comfort Station relocated. Parking Area revised.
		Slope revised, berms deleted, note added.
		[illegible]

U.S. ARMY ENGINEER DISTRICT, GARRISON
CORPS OF ENGINEERS

CONNECTICUT RIVER FLOOD CONTROL
TOWNSHEND DAM
GENERAL PLAN
WEST RIVER. VERMONT

1958

CT-1-5304
SHEET 13



NOTES

For plan of embankment see Sheet 13.
For horizontal control see Sheet ...
Except where dimensioned stripping ... be carried down to suitable material.
Figures in hexagons indicate item under which payment will be made.
All bedrock surfaces contacting compacted impervious fill to receive rock surface treatment.
... river gravel ... Pervious fill and Rock fill upstream ... Impervious section of the embankment and above elev. 515±, except the five-foot protective Rock Fill Blanket measured normal to the slope on the upstream slope of the embankment.
For revised embankment sections see Dwg. CT-1-5306, Sheet 15A.

PREPARED BY THE GARRISON DISTRICT FOR THE U. S. ARMY ENGINEER DIVISION, NEW ENGLAND

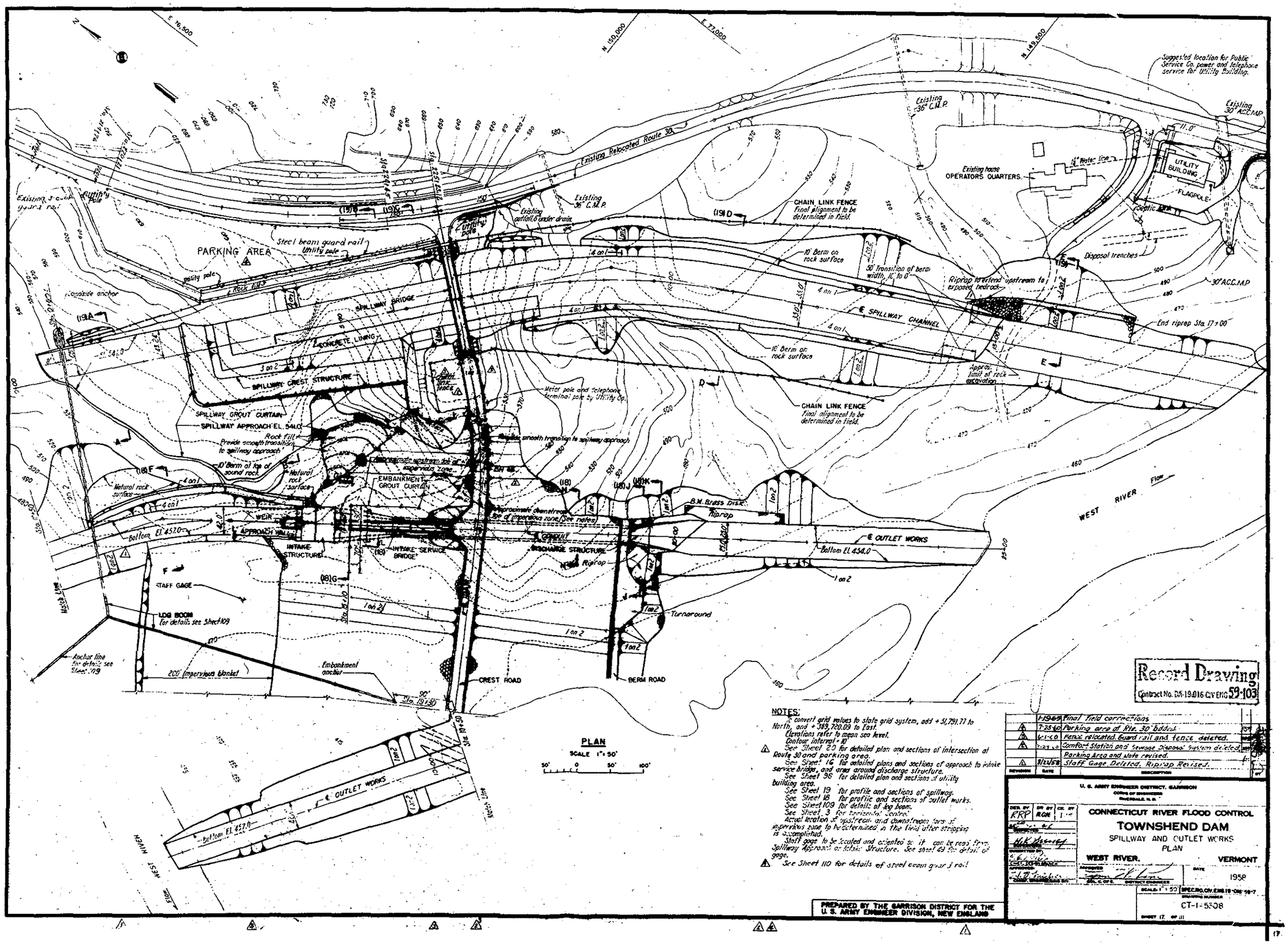
Revision	Date	Description
	1-19-65	Final field corrections
1		

U. S. ARMY ENGINEER DISTRICT, GARRISON
CORPS OF ENGINEERS
RIVERDALE, N. D.

CONNECTICUT RIVER FLOOD CONTROL
TOWNSHEND DAM
EMBANKMENT
SECTIONS NO 1
WEST RIVER, VERMONT

Date: JULY 1958
Spec. No. CIV ENG 19-016-59-7
Drawing Number: CT-1-5306
Sheet 15 of 111

15



NOTES:

To convert grid values to state grid system, add +51,791.77 to North, and +389,720.09 to East.
Elevations refer to mean sea level.
Contour interval = 10'
A See Sheet 20 for detailed plan and sections of intersection of Route 30 and parking area.
See Sheet 16 for detailed plans and sections of approach to intake service bridge, and areas around discharge structure.
See Sheet 96 for detailed plan and sections of utility building area.
See Sheet 19 for profile and sections of spillway.
See Sheet 18 for profile and sections of outlet works.
See Sheet 109 for details of log boom.
See Sheet 3 for horizontal control.
Actual location of upstream and downstream toes of impervious zone to be determined in the field after stripping is accomplished.
Staff gage to be located and oriented so it can be read from Spillway Approach or Intake Structure. See sheet 69 for detail of gage.
A See Sheet 110 for details of steel beam guard rail

PREPARED BY THE GARRISON DISTRICT FOR THE U.S. ARMY ENGINEER DIVISION, NEW ENGLAND

Record Drawing
Contract No. DA-19-016 CIV ENG 59-103

REVISION	DATE	DESCRIPTION	BY
	1-1959	Final field corrections	
A	7-25-60	Parking area of Rte. 30 added	RPP
A	6-1-60	Fence relocated. Guard rail and fence deleted.	RPP
A	7-21-60	Comfort Station and Sewage Disposal System deleted.	RPP
		Parking Area and slope revised.	
A	8/24/60	Staff Gage Deleted, Riprap Revised.	

U. S. ARMY ENGINEER DISTRICT, GARRISON
CORPS OF ENGINEERS
RIVERDALE, N.D.

DES. BY KRP | DR. BY RLGN | CK. BY

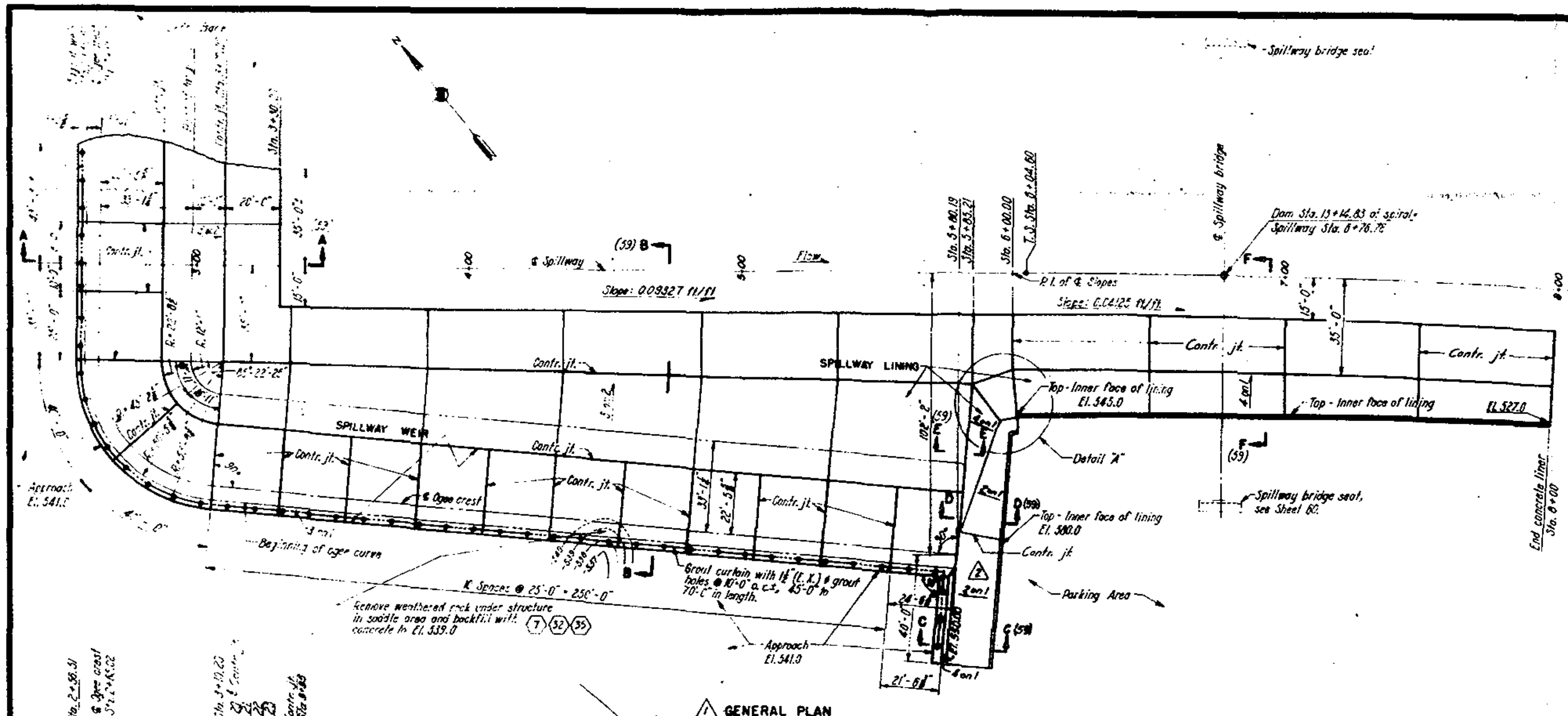
CONNECTICUT RIVER FLOOD CONTROL
TOWNSHEND DAM
SPILLWAY AND OUTLET WORKS
PLAN
WEST RIVER, VERMONT

DATE 1958

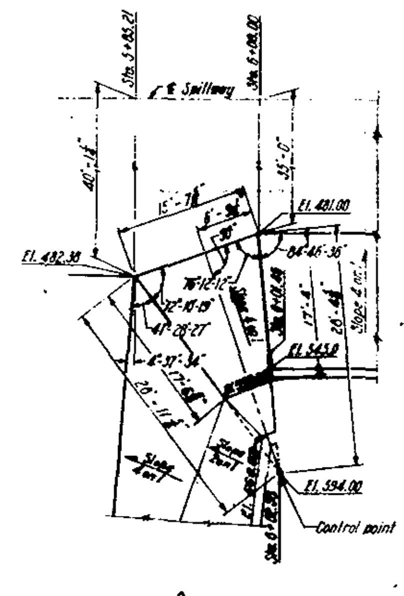
SCALE 1" = 50' | SPEC. NO. CIV. ENG 19-016-59-7

CT-1-5508

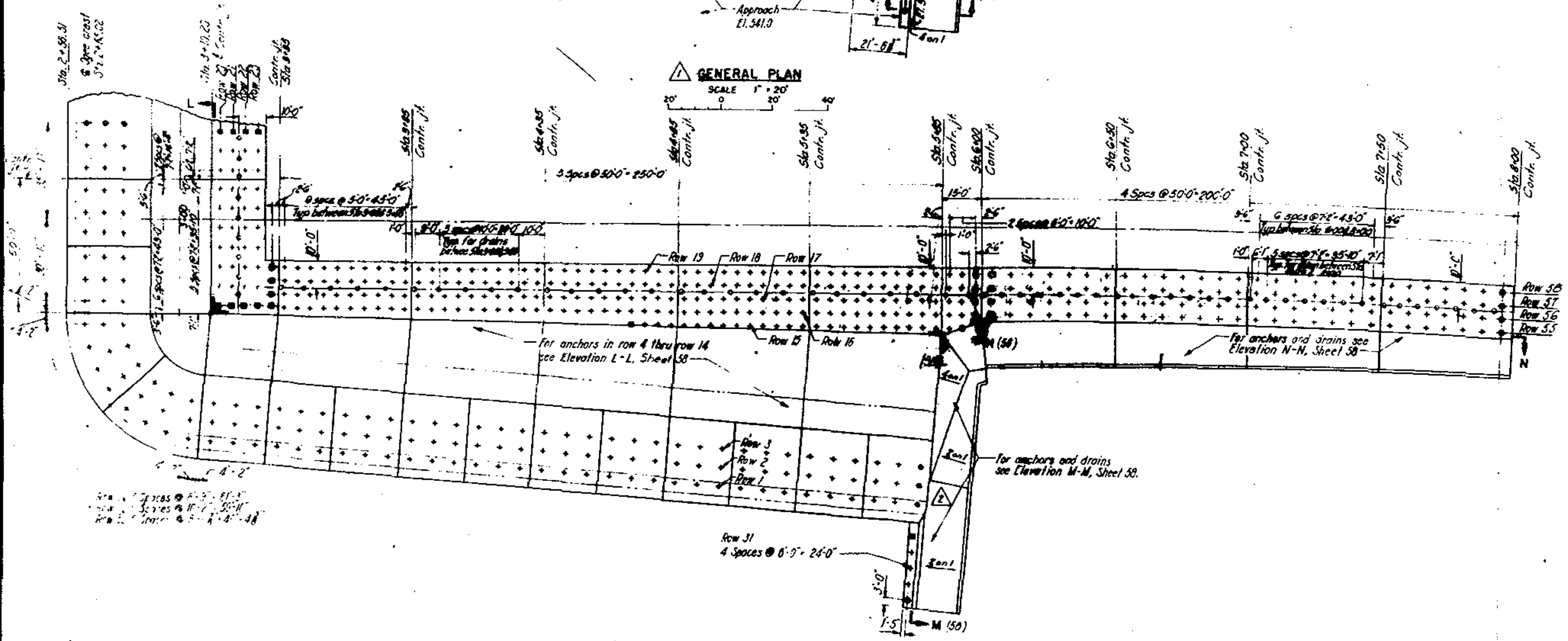
SHEET 17 OF 111



GENERAL PLAN
SCALE 1" = 20'



DETAIL "A"
SCALE 1/8" = 1'-0"



PLAN OF ANCHORS AND DRAINAGE
SCALE 1" = 20'

Record Drawing
Contract No. DA-19-016-CIV ENG 59-103

NOTES:
Work this sheet with Sheets 58 and 59.
For General Plan and Location, see Sheet 13.
For spillway excavation details, see Sheet 19.
The symbols ■ and ● denote terminal points of type A and type B anchors, respectively.
The symbol ● denotes grout holes.
The symbol ● denotes drain holes.
Figures in hexagons indicate item numbers under which payment will be made.
Drains shown on this sheet will be paid for under Item Nos. 16 and 18.
Grout curtain shown on this sheet will be paid for under Item Nos. 16, 17, 20, 21 and 22.
Anchors shown on this sheet will be paid for under Item No. 24.
Concrete shown on this sheet will be paid for under Item Nos. 32, 33 and 35.

Revision	Date	Description
2	6-1-60	Spillway lining revised.
1	8-20-58	Contraction joints added. Anchors & drains rearranged

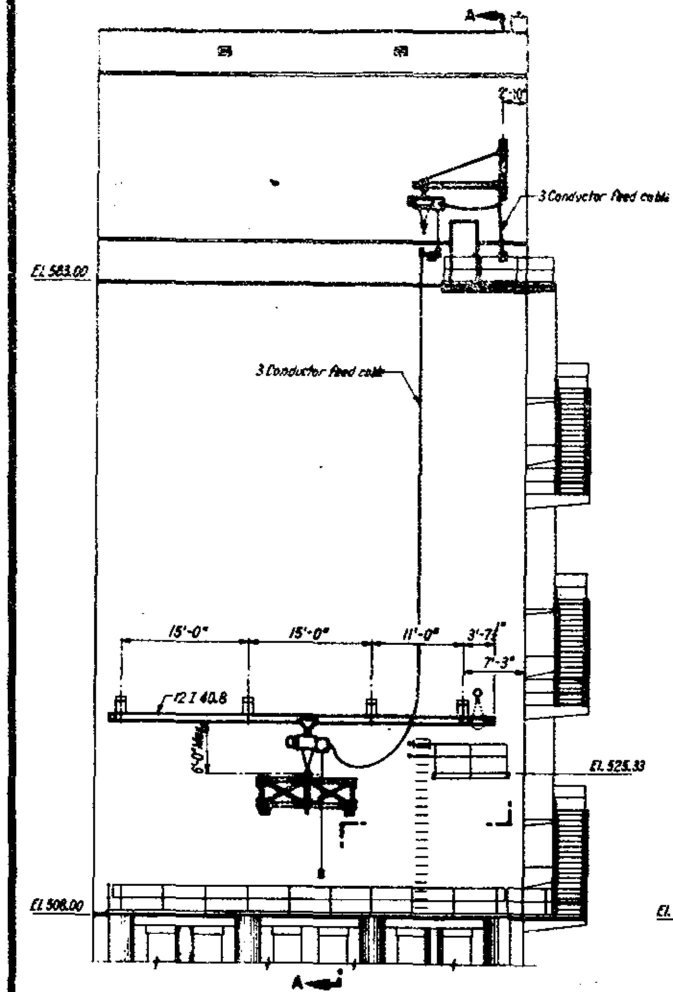
U. S. ARMY ENGINEER DISTRICT, GARRISON
CORPS OF ENGINEERS
RIVERDALE, N. D.

CONNECTICUT RIVER FLOOD CONTROL
TOWNSHEND DAM
SPILLWAY
WEIR & LINING
PLANS
WEST RIVER, VERMONT

Des. by M.G.B. | Tr. by R.C.H. | Ck. by M.G.B.

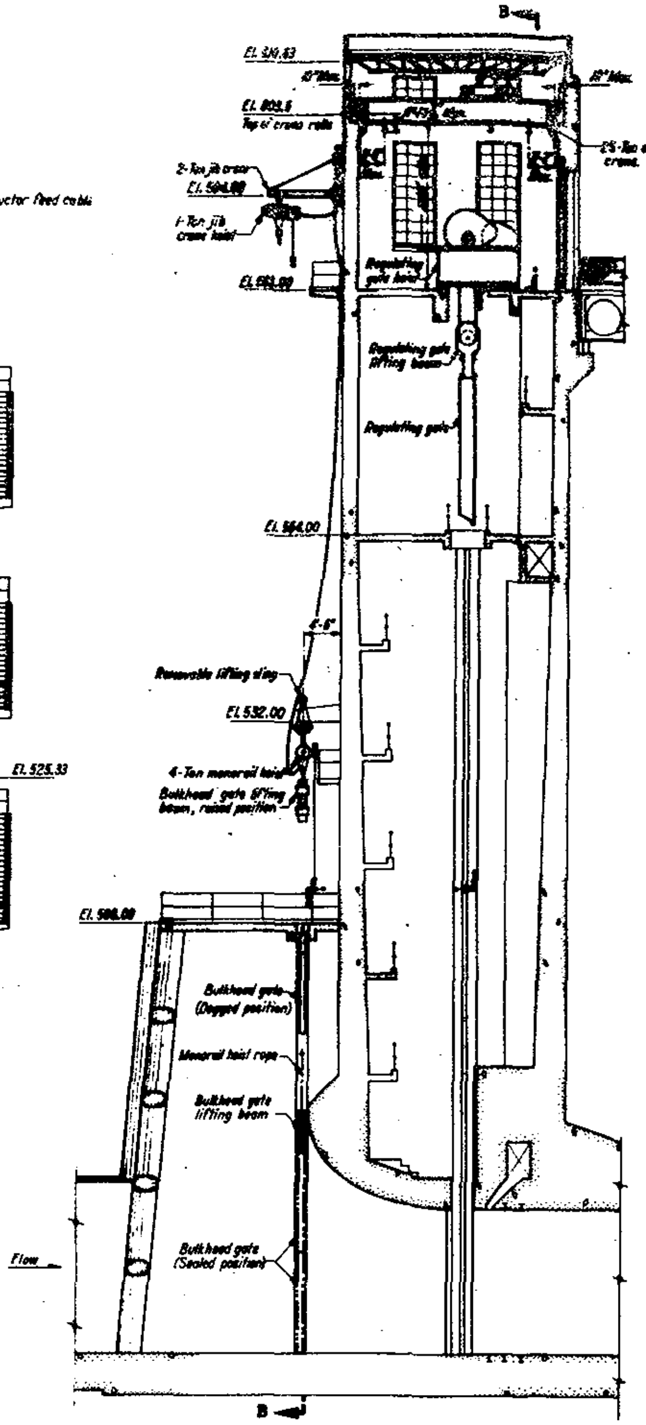
JULY 1958
SCALE: AS SHOWN
CT-1-5349
SHEET 57 OF 111

PREPARED BY THE GARRISON DISTRICT FOR THE U. S. ARMY ENGINEER DIVISION, NEW ENGLAND



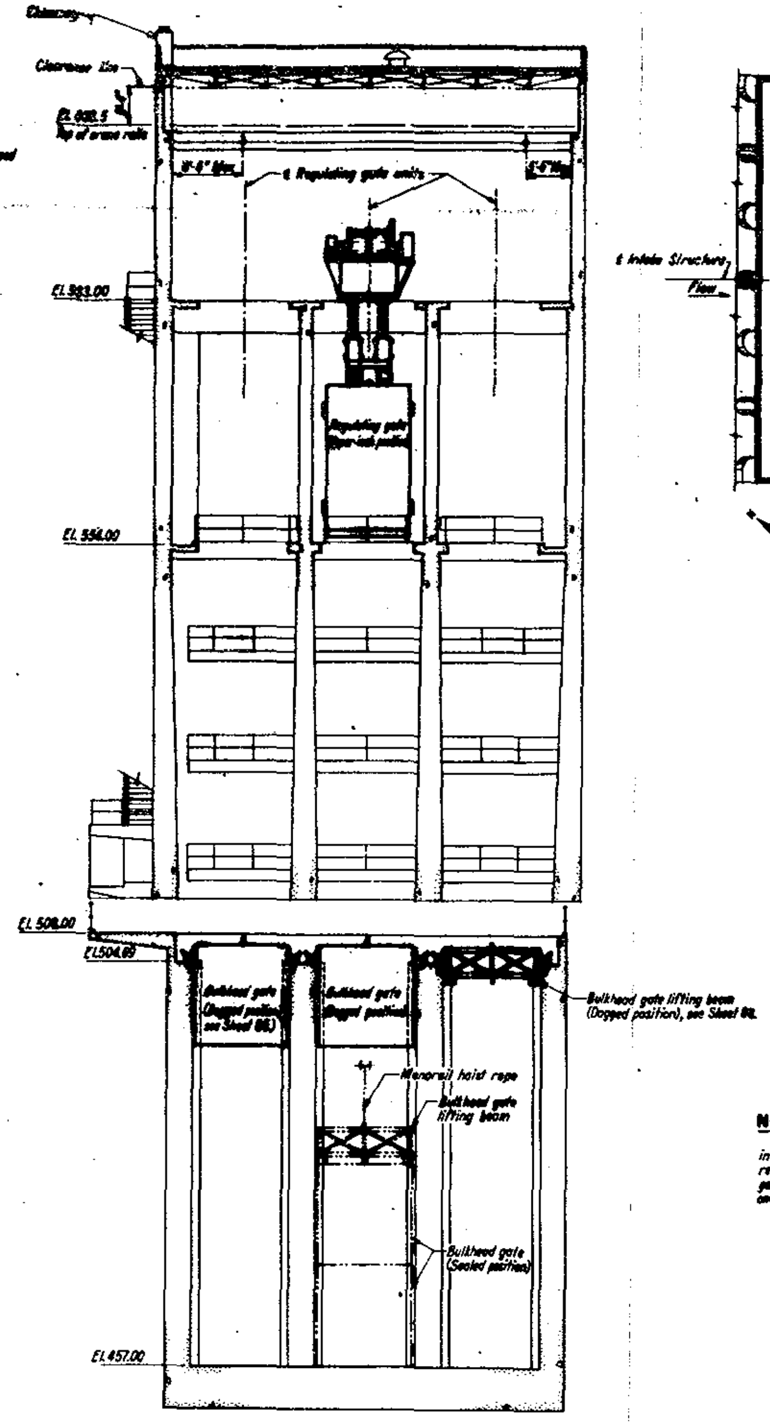
UPSTREAM ELEVATION

SCALE 1/8" = 1'-0"



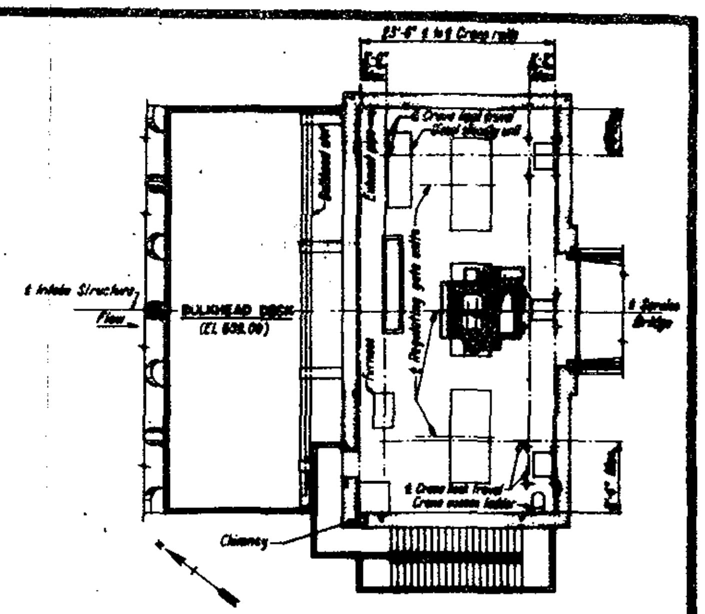
SECTION A-A

SCALE 1/8" = 1'-0"



SECTION B-B

SCALE 1/8" = 1'-0"



PLAN EL. 583.00

SCALE 1/8" = 1'-0"

NOTES

1. Bulkhead gates and bulkhead gate lifting beam are shown on this sheet in various locations to indicate function and operation method. The actual requirements are two bulkhead gates, one bulkhead gate lifting beam, three regulating gates, three regulating gate hoists, one overhead crane, one jib crane and hoist and one monorail hoist.
2. The following will be paid for under items as shown:
   - Regulating gate hoists - Item No. 45.
   - Regulating gates - Item No. 44.
   - Overhead crane - Item No. 46.
   - Monorail hoist - Item No. 48.
   - Jib crane - Item No. 49.
   - Bulkhead gates - Item No. 47.
   - Bulkhead gate lifting beam - Item No. 47.

Record Drawing
Contract No. DA-19-016-CIV ENG 59-105

CONNECTICUT RIVER FLOOD CONTROL

TOWNSHEND DAM

GATES, HOISTS & CRANES
GENERAL ARRANGEMENT

WEST RIVER, VERMONT

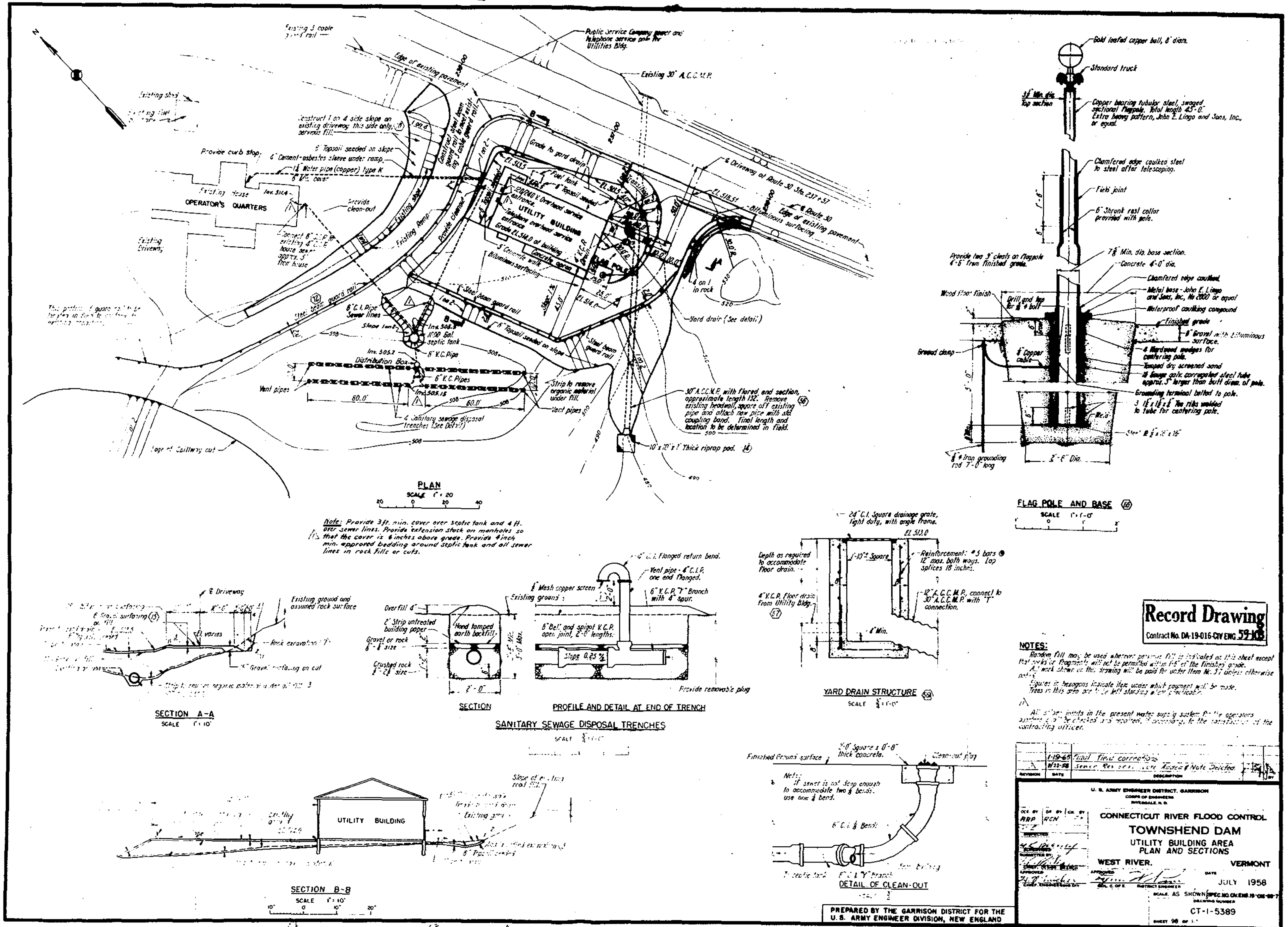
JULY 1958

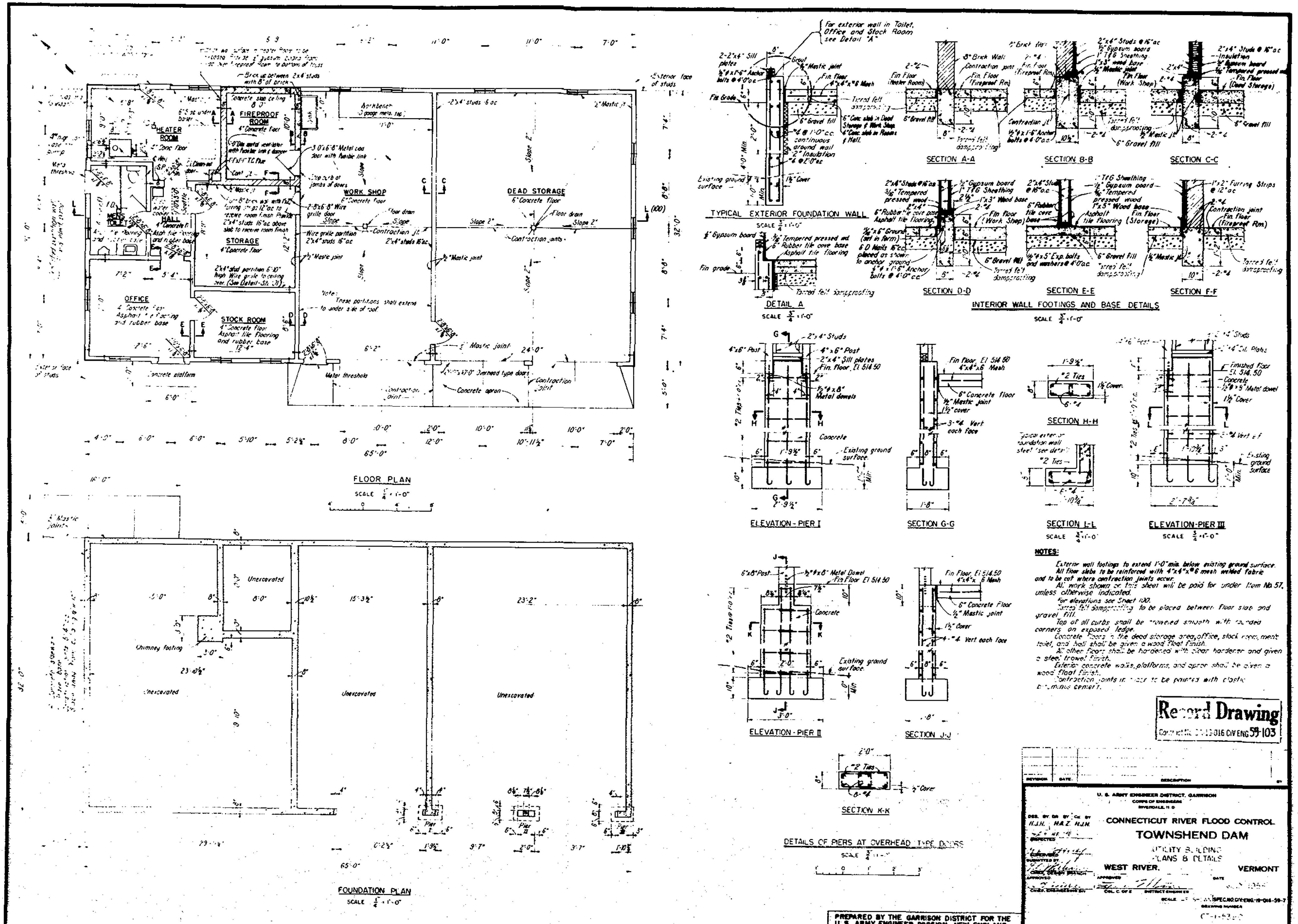
SCALE: 1/8" = 1'-0"

CT-1-5358

SHEET 67 OF 111

PREPARED BY THE GARRISON DISTRICT FOR THE U.S. ARMY ENGINEER DIVISION, NEW ENGLAND


N
Existing shed
Existing 3 cable guard rail
Public Service Company power and telephone service pole for Utilities Bldg.
Existing 30" A.C.C.M.P.
Edge of existing pavement
Construct 1 on 4 side slope on existing driveway this side only, pervious fill.
6" Topsoil seeded on slope
4" Cement-asbestos sleeve under ramp.
1½" Water pipe (copper) type K
6" Min. cover
Provide curb stop
Existing House
OPERATOR'S QUARTERS
Inv. 511.4
Provide clean-out
Connect 6" C.I.P. to existing 4" C.I.P. house sewer approx. 5' from house
Existing Driveway
Existing slope
Existing Ramp
Provide cleanout
Construct steel beam guard rail to meet existing 3 cable guard rail.
Grade to yard drain
EL 513.5
Fuel tank
6" Topsoil seeded
120/240 V. Overhead service entrance.
UTILITY BUILDING
Telephone overhead service entrance
Grade EL.514.0 at building
5" Concrete walk
Concrete apron
Bituminous surfacing
Transition
FLAG POLE
℄ Driveway at Route 30 Sta. 237+57
EL 516.5
℄ Route 30
Edge of existing pavement
Bituminous surfacing
4 on 1 in rock
Yard drain (See detail)
Steel beam guard rail
6" Topsoil seeded on slope
Steel beam guard rail
6" C.I. Pipe Sewer lines
Slope 1 on 2
Inv. 508.3
1000 Gal. septic tank
Inv. 505.2
Distribution Box
6" V.C. Pipe
6" V.C. Pipes
Inv. 505.18
Vent pipes
60.0'
4 Sanitary sewage disposal trenches (See Detail)
Strip to remove organic material under fill.
30" A.C.C.M.P. with flared end section, approximate length 132'. Remove existing headwall, square off existing pipe and attach new pipe with std coupling band. Final length and location to be determined in field.
10' x 10' x 1' Thick riprap pad.
Edge of Spillway cut
PLAN
SCALE 1" = 20
Note: Provide 3 ft. min. cover over septic tank and 4 ft. over sewer lines. Provide extension stack on manholes so that the cover is 6 inches above grade. Provide 4 inch min. approved bedding around septic tank and all sewer lines in rock fills or cuts.
Gold leafed copper ball, 8" diam.
Standard truck
3⅞" Min. dia. Top section
Copper bearing tubular steel, swaged sectional flagpole. Total length 45'-0". Extra heavy pattern, John E. Lingo and Sons, Inc., or equal.
Chamfered edge caulked steel to steel after telescoping.
Field joint
6" Shrunk rest collor provided with pole.
Provide two 9" cleats on flagpole 4'-6" from finished grade.
7⅞" Min. dia. base section.
Concrete 4'-0" dia.
Chamfered edge caulked
Metal base - John E. Lingo and Sons, Inc., No 2000 or equal
Waterproof caulking compound
Finished grade
6" Gravel with bituminous surface.
4 Hardwood wedges for centering pole.
Tamped dry screened sand
16 Gauge galv. corrugated steel tube approx. 5" larger than butt diam. of pole.
Grounding terminal bolted to pole.
3 1½ x 1½ x ¼ Tee ribs welded to tube for centering pole.
Weld
Wood float finish
Drill and tap for ⅜" ϕ bolt
Ground clamp
¼" Copper cable
⅝" ϕ Iron grounding rod 7'-0" long
2'-6" Dia.
FLAG POLE AND BASE
SCALE 1" = 1'-0"
℄ Driveway
Existing ground and assumed rock surface
Rock excavation
El. varies
SECTION A-A
SCALE 1" = 10'
Overfill 4"
2" Strip untreated building paper
Hand tamped earth backfill.
Gravel or rock
Crushed rock
2'-0"
Existing ground
¼" Mesh copper screen
4" C.I. Flanged return bend.
Vent pipe - 4" C.I.P. one end flanged.
6" V.C.P. "T" Branch with 4" spur.
6" Bell and spigot V.C.P. open joint, 2'-0" lengths.
Slope 0.25 %
Provide removable plug
SECTION
PROFILE AND DETAIL AT END OF TRENCH
SANITARY SEWAGE DISPOSAL TRENCHES
24" C.I. Square drainage grate, light duty, with angle frame.
EL 513.0
1'-10" Square
Reinforcement: #5 bars @ 12" max. both ways. Lap splices 18 inches.
Depth as required to accommodate floor drain.
4" V.C.P. Floor drain from Utility Bldg.
12" A.C.C.M.P. connect to 30" A.C.C.M.P. with "T" connection.
4" Min.
YARD DRAIN STRUCTURE
SCALE ¾" = 1'-0"
UTILITY BUILDING
SECTION B-B
SCALE 1" = 10'
2'-0" Square x 0'-8" thick concrete.
Finished Ground surface
Cleanout plug
6" C.I. ⅛ Bend
DETAIL OF CLEAN-OUT
Record Drawing
Contract No. DA-19-016-CIV ENG 59-103
NOTES:
Random fill may be used wherever pervious fill is indicated on this sheet except that rocks or fragments will not be permitted within 1'-6" of the finished grade.
All work shown on this drawing will be paid for under Item No. 37 unless otherwise noted.
Figures in hexagons indicate item under which payment will be made.
Trees in this area are to be left standing where practicable.
All solder joints in the present water supply system for the operators quarters shall be checked and repaired, if necessary, to the satisfaction of the contracting officer.
1-19-65 Final field corrections
REVISION DATE DESCRIPTION
U. S. ARMY ENGINEER DISTRICT, GARRISON
CORPS OF ENGINEERS
CONNECTICUT RIVER FLOOD CONTROL
TOWNSHEND DAM
UTILITY BUILDING AREA
PLAN AND SECTIONS
WEST RIVER. VERMONT
JULY 1958
SCALE AS SHOWN
CT-1-5389
PREPARED BY THE GARRISON DISTRICT FOR THE U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
98



NOTES:

Exterior wall footings to extend 1'-0" min. below existing ground surface.

All floor slabs to be reinforced with 4"x4"x#6 mesh welded fabric and to be cut where contraction joints occur.

All work shown on this sheet will be paid for under Item No. 57, unless otherwise indicated.

For elevations see Sheet 100.

Tarred felt dampproofing to be placed between floor slab and gravel fill.

Top of all curbs shall be troweled smooth with rounded corners on exposed ledge.

Concrete floors in the dead storage area, office, stock room, mens toilet, and hall shall be given a wood float finish.

All other floors shall be hardened with clear hardener and given a steel trowel finish.

Exterior concrete walks, platforms, and apron shall be given a wood float finish.

Contraction joints in floor to be painted with plastic bituminous cement.

Record Drawing
Contract No. [illegible]-016 CIV ENG 59-103

REVISION	DATE	DESCRIPTION	BY

U. S. ARMY ENGINEER DISTRICT, GARRISON
CORPS OF ENGINEERS
RIVERDALE, N. D.

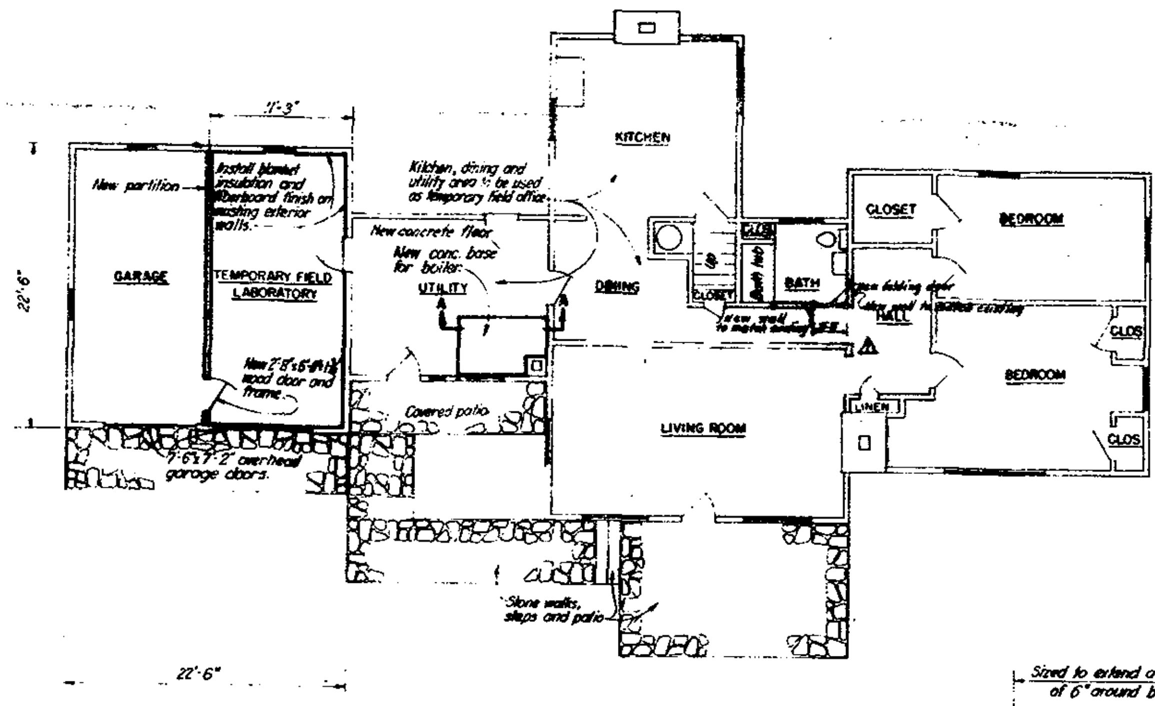
DES. BY H.J.H. | DR. BY H.A.Z. | CK. BY H.J.H.

CONNECTICUT RIVER FLOOD CONTROL
TOWNSHEND DAM
UTILITY BUILDING
PLANS & DETAILS
WEST RIVER, VERMONT

INSPECTED · SUBMITTED BY · CHIEF, DESIGN BRANCH · APPROVED · CHIEF, ENGINEERING DIV · COL. C. OF E. · DISTRICT ENGINEER · DATE

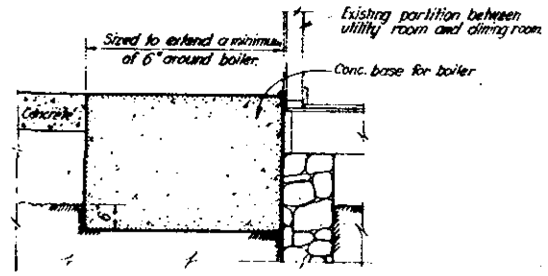
SCALE: AS SHOWN | SPEC. NO. CIV-ENG-19-016-59-7
DRAWING NUMBER
SHEET 99 OF 11[illegible]

PREPARED BY THE GARRISON DISTRICT FOR THE U. S. ARMY ENGINEER DIVISION, NEW ENGLAND



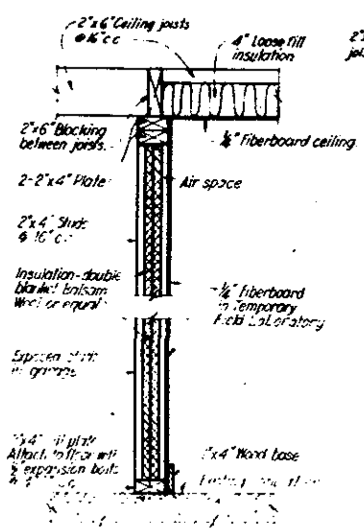
PLAN - EXISTING HOUSE WITH MODIFICATIONS

SCALE 3/16" = 1'-0"



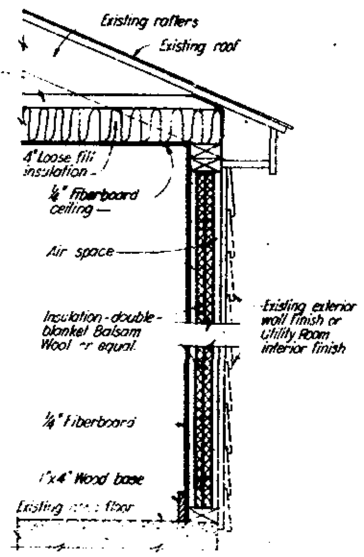
SECTION A-A

NOT TO SCALE



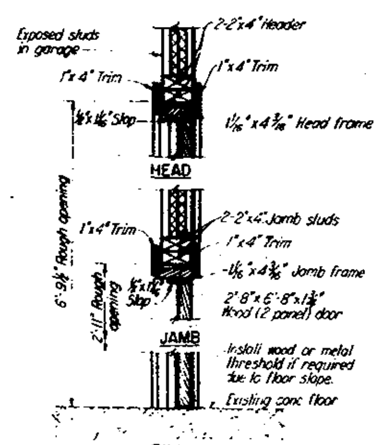
NEW PARTITION BETWEEN GARAGE AND TEMPORARY FIELD LABORATORY

SCALE 1½" = 1'-0"



INSULATION AND INTERIOR FINISH - EXISTING WALLS, TEMPORARY FIELD LABORATORY

SCALE 1½" = 1'-0"



SILL

DETAILS OF DOOR IN NEW PARTITION

SCALE 1½" = 1'-0"

NOTES:

Garage door into Temporary Field Laboratory shall be sealed shut and insulated on the inside face below the glazed portion. Insulation may be of a type manufactured with fibered insulation backing and fiber board surface similar and equal to Insulite 2 inch Roof Deck, or may be a fabricated panel made of furring strips, blanket insulation and fiberboard finish. The completed installation shall present a neat finished appearance, conforming as nearly as possible to the finished walls.

Light lines on this sheet indicate existing structure. Heavy lines indicate modifications or new work to be done.

All work shown on this sheet will be paid for under Item No. 59, unless otherwise indicated.

Existing floors in Utility, Kitchen and Dining rooms and passage to Bath shall be covered with linoleum for protection during use as temporary field office.

Temporary closure panel between Dining and Living rooms shall be installed with a minimum number of nails or screws.

All cracks in existing foundation walls shall be repaired as directed by the Contracting Officer.

Exterior foundation walls in the living room, bedroom, bath and kitchen areas shall be insulated with 2" rigid insulation attached to the inside of the walls with asphalt emulsion or other approved means.

See specifications for removal of part of temporary closure panel and garage door insulation.

Record Drawing

Contract No. DA-19-016-CIV ENG-59-103

Revision	Date	Description
	1-19-65	Final field corrections
⚠	8-21-58	Bath rm & hall walls revised

U. S. ARMY ENGINEER DISTRICT, GARRISON
CORPS OF ENGINEERS
RIVERDALE, N. D.

Des. by	Dr. by	Ck. by
H.J.H.	R.G.E.	H.J.H.

CONNECTICUT RIVER FLOOD CONTROL

TOWNSHEND DAM

OPERATORS' QUARTERS MODIFICATION

WEST RIVER, VERMONT

DATE: JULY 1956

SCALE: AS SHOWN

CT-1-5398

SHEET 107 OF 11

PREPARED BY THE GARRISON DISTRICT FOR THE U. S. ARMY ENGINEER DIVISION, NEW ENGLAND